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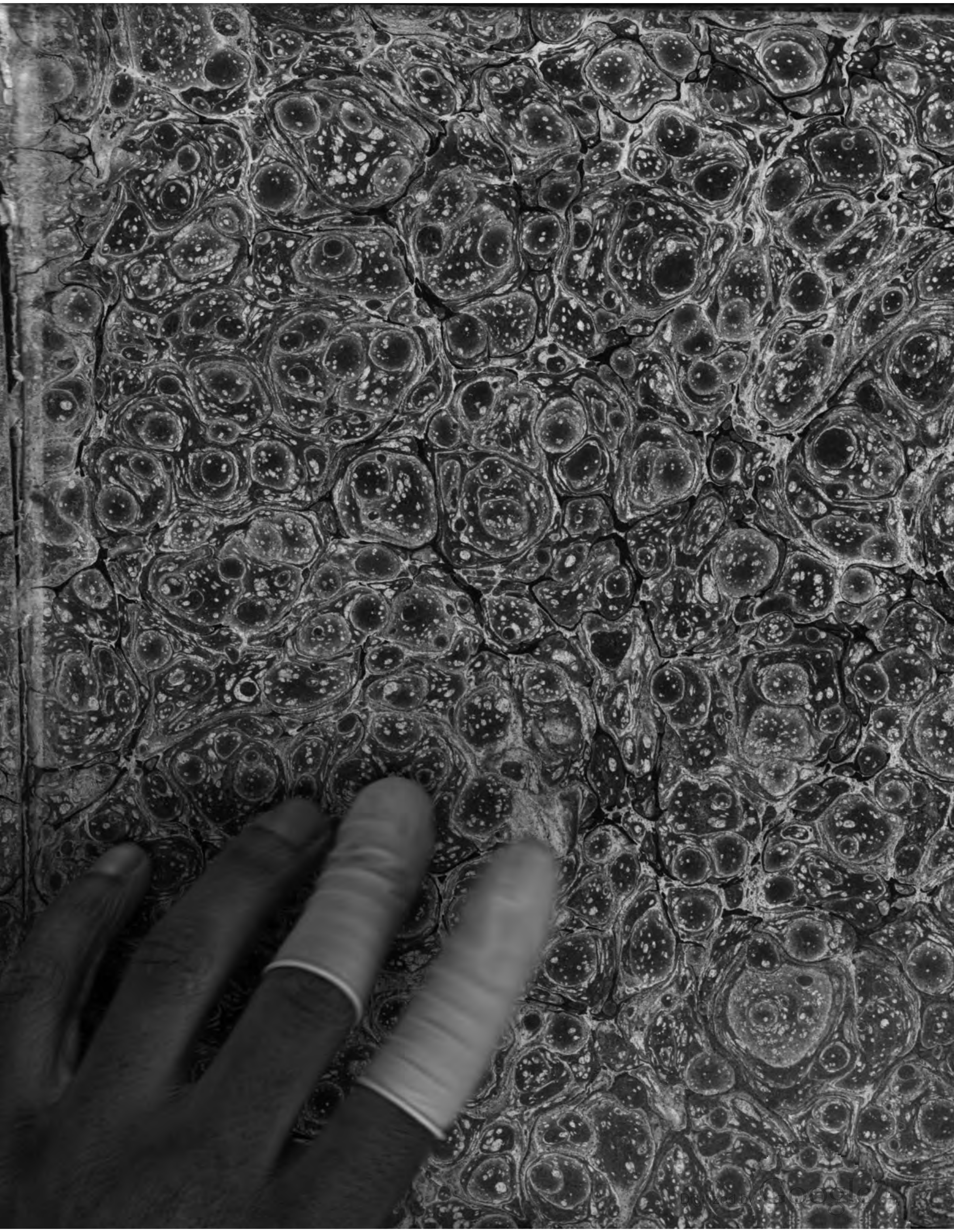

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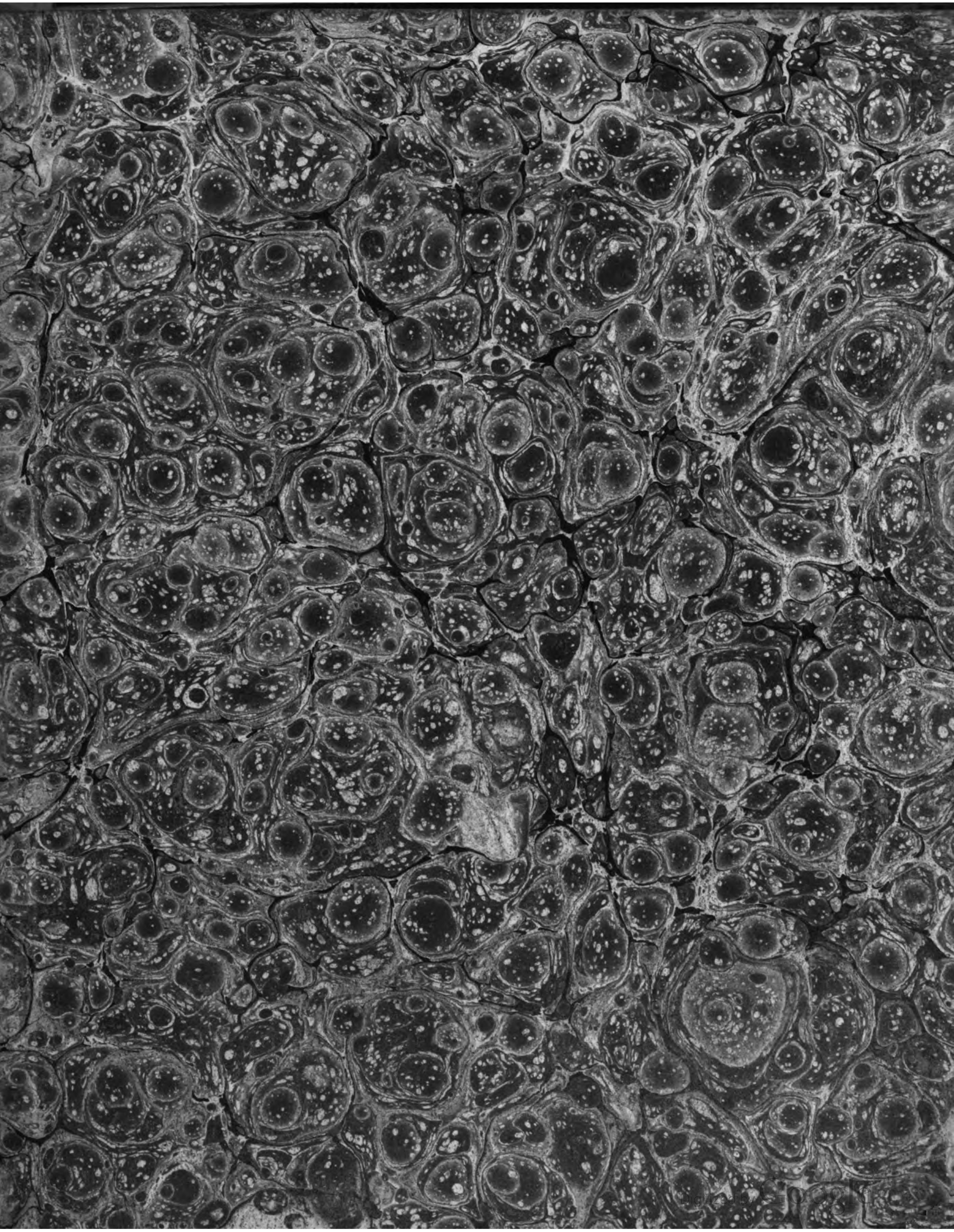

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ENCYCLOPÆDIA BRITANNICA.

PARTHIA, a celebrated empire of antiquity, bounded on the west by Media, on the north by Hyrcania, on the east by Aria, on the south by Carmania the desert; surrounded on every side by mountains, which still serve as a boundary, though its name is now changed, having obtained that of *Eyrac* or *Arac*; and, to distinguish it from Chaldæa, that of *Eyrac Agami*. By Ptolemy it is divided into five districts, viz. Caminsine or Gamisene, Partheyne, Choroane, Atticene, and Tabiene. The ancient geographers enumerate a great many cities in this country. Ptolemy in particular reckons 25 large cities; and it certainly must have been very populous, since we have accounts of 2000 villages, besides a number of cities, which were destroyed by earthquakes. Its capital was named *Hecatompolis*, from the circumstance of its having 100 gates. It was a noble and magnificent place; and, according to some, it still remains under the name of *Ispahan*, the capital of the present Persian empire.

1 Ancient divisions.

2 Whence peopled.

Parthia is by some supposed to have been first peopled by the Phetri or Pathri, often mentioned in Scripture, and that the Parthians are descended from Pathrusim the son of Misraim. But however true this may be with regard to the ancient inhabitants, yet is is certain, that those Parthians who were so famous in history, descended from the Scythians, though from what tribe we are not certainly informed.

3 Cause of the Parthians revolt from Antiochus Theus.

The history of the ancient Parthians is totally lost. All that we know about them is, that they were first subject to the Medes, afterwards to the Persians, and lastly to Alexander the Great. After his death the province fell to Seleucus Nicator, and was held by him and his successors till the reign of Antiochus Theus, about the year 250 before Christ. At this time the Parthians revolted, and chose one Arsaces for their king. The immediate cause of this revolt was the lewdness of Agathocles, to whom Antiochus had committed the care of all the provinces beyond the Euphrates. This man made an infamous attempt on Tiridates, a youth of great beauty; which so enraged his brother Arsaces, that he excited his countrymen to revolt; and before Antiochus had leisure to attend to the rebellion, it became too powerful to be crushed. Seleucus Callinicus, the successor of Antiochus Theus, attempted to reduce Arsaces; but the latter having had so much time to strengthen himself, defeated and drove his antagonist out of the country. Seleucus, however, in a short time, undertook another expedition against Arsaces; but was still more unfortunate than he had been in the former, being not only defeated in a great battle, but taken prisoner, and died in captivity. The day on which Arsaces gained this victory was ever after observed among the Parthians as an extraordinary festival. Arsaces being thus fully established in his new kingdom, reduced Hyrcania and some other provinces under his power; and was at last killed in a battle against Ariarthes IV. king of Cappadocia. From this prince all the other kings of Parthia took the surname of *Arsaces*, as those of Egypt did that of *Ptolemy*, from Ptolemy Soter.

Arsaces I. was succeeded by his son Arsaces II. who, entering Media, made himself master of that country, while Antiochus the Great was engaged in war with Ptolemy Euergetes king of Egypt. Antiochus, however, was no sooner disengaged from that war, than he marched with all his forces against Arsaces, and at first drove him quite out of Media. But he soon returned with an army of 100,000 foot and 20,000 horse, with which he put a stop to the further progress of Antiochus; and a treaty was soon after concluded, in which it was agreed, that Arsaces should remain master of Parthia and Hyrcania, upon condition of his assisting him in his wars with other nations.

4 Conquests of the Parthian monarchs.

Arsaces II. was succeeded by his son Priapatius, who reigned 15 years, and left three sons, Phrahates, Mithridates, and Artabanus. Phrahates, the elder, succeeded to the throne, and reduced under his subjection the Mardi, who had never been conquered by any but Alexander the Great. After him, his brother Mithridates was invested with the regal dignity. He reduced the Bactrians, Medes, Persians, Elymeans, and overran in a manner all the east, penetrating beyond the boundaries of Alexander's conquests. Demetrius Nicator, who then reigned in Syria, endeavoured to recover those provinces; but his army was entirely destroyed, and himself taken prisoner, in which state he remained till his death; after which victory Mithridates made himself master of Babylonia and Mesopotamia, so that all the provinces between the Euphrates and the Ganges were now subject to his power.

5 Antiochus Sidetes destroyed with his whole army.

Mithridates died in the 37th year of his reign, and left the throne to his son Phrahates II. who was scarce settled in his kingdom when Antiochus Sidetes marched against him at the head of a numerous army, under pretence of delivering his brother Demetrius, who was still in captivity. Phrahates was defeated in three pitched battles; in consequence of which he lost all the countries conquered by his father, and was reduced within the limits of the ancient Parthian kingdom. Antiochus did not, however, long enjoy his good fortune; for his army, on account of their number, amounting to no fewer than 400,000, being obliged to separate to such distances as prevented them, in case of any sudden attack, from joining together, the inhabitants, whom they had most cruelly oppressed, taking advantage of this separation, conspired with the Parthians to destroy them. This was accordingly executed; and the vast army of Antiochus, with the monarch himself, were slaughtered in one day, scarcely a single person escaping to carry the news to Syria. Phrahates, elated with this success, proposed to invade Syria; but in the mean time, happening to quarrel with the Scythians, he was by them cut off with his whole army, and was succeeded by his uncle Artabanus.

6
Alliance concluded with the Romans.

The new king enjoyed his dignity but a very short time, being, a few days after his accession, killed in another battle with the Scythians. He was succeeded by Pacorus I. who entered into an alliance with the Romans; and he by Phrahates III. This monarch took under his protection Tigranes the son of Tigranes the Great, king of Armenia, gave him his daughter in marriage, and invaded the kingdom with a design to place the son on the throne of Armenia; but on the approach of Pompey he thought proper to retire, and soon after solemnly renewed the treaty with the Romans.

7
Crassus resolves on a war with the Parthians.

Phrahates was murdered by his children Mithridates and Orodes; and soon after the former was put to death by his brother, who thus became sole master of the Parthian empire. In his reign happened the memorable war with the Romans under Crassus. This was occasioned not by any breach of treaty on the side of the Parthians, but through the shameful avarice of Crassus. The whole Roman empire at that time had been divided between Cæsar, Pompey, and Crassus; and by virtue of that partition, the eastern provinces had fallen to the lot of Crassus. No sooner was he invested with this dignity, than he resolved to carry the war into Parthia, in order to enrich himself with the spoils of that people, who were then looked upon to be very wealthy. Some of the tribunes opposed him, as the Parthians had religiously observed the treaty; but Crassus having, by the assistance of Pompey, carried every thing before him, left Rome in the year 55 B. C. and pursued his march to Brundusium, where he immediately embarked his troops, though the wind blew very high; and after a difficult passage, where he lost many of his ships, he reached the ports of Galatia.

8
Plunders the temple at Jerusalem.

From Galatia Crassus hastened to Syria, and passing through Judea, plundered the temple at Jerusalem in his way. He then marched with as great expedition as he could to the river Euphrates, which he crossed on a bridge of boats: and, entering the Parthian dominions, began hostilities. As the enemy had not expected an invasion, they were quite unprepared for resistance; and therefore Crassus overran all Mesopotamia; and if he had taken advantage of the consternation which the Parthians were in, might have also reduced Babylonia. But instead of this, early in the autumn, he repassed the Euphrates, leaving only 7000 foot and 1000 horse to garrison the places he had reduced; and putting his army into winter quarters in Syria, gave himself wholly up to his favourite passion of amassing money.

Early in the spring, the Roman general drew his forces out of their winter quarters, in order to pursue the war with vigour; but, during the winter, Orodes had collected a very numerous army, and was well prepared to oppose him. Before he entered upon action, however, the Parthian monarch sent ambassadors to Crassus, in order to expostulate with him on his injustice in attacking an ally of the Roman empire; but Crassus, without attending to what they said, only returned for answer, that "they should have his answer at Seleucia."

9
His so dishea ed.

Orodes, finding that a war was unavoidable, divided his army into two bodies. One he commanded in person, and marched toward Armenia, in order to oppose the king of that country, who had raised a considerable army to assist the Romans. The other he sent into Mesopotamia, under the command of Surena or Surenas, a most experienced general, by whose conduct all the cities which Crassus had reduced were quickly retaken. On this some Roman soldiers who made their escape, and fled to the camp of Crassus, filled the mind of his army with terror at the accounts of the number, power, and strength, of the enemy. They told their fellow soldiers, that the Parthians were very numerous, brave, and well disciplined; that it was impossible to overtake them when they fled, or escape them when they pursued; that their defensive weapons were proof against the Roman darts, and their offensive weapons so sharp, that no buckler could resist them, &c. Crassus looked upon all this only as the effect of cowardice: but the common soldiers, and even many of the chief officers, were so disheartened, that Cassius, the same who afterwards conspired against Cæsar, and most of the legionary tribunes, advised Crassus to suspend his march, and consider better of the enterprise before he proceeded farther in it. But Crassus obstinately persisted in his former resolution, being encouraged by the arrival of Artabazus king of Armenia, who brought with him 6000 horse, and promised to send 10,000 cuirassiers and 30,000 foot, whenever he should stand in need of them. At the same time, he advised him by no means to march his army through the plains of Mesopotamia, but to take his route over the mountains of Armenia. He told him, that as Armenia was a mountainous country, the enemy's cavalry, in which their main strength consisted, would there be entirely useless; and besides, his army would there be plentifully supplied with all manner of necessaries: whereas, if he marched by the way of Mesopotamia, he would be perpetually harassed by the Parthian horse, and frequently be obliged to lead his army through sandy deserts, where he would be distressed for want of water and all other provisions. This salutary advice, however, was rejected, and Crassus entered Mesopotamia with an army of about 40,000 men.

The Romans had no sooner crossed the Euphrates, than Cassius advised his general to advance to some of those towns in which the garrisons yet remained, in order to halt and refresh his troops: or if he did not choose to follow this advice, he said that his best way would be to march along the banks of the Euphrates to Seleucia;

10 Betrayed by Abgarus king of Edessa.

cia; as by this method he would prevent the Parthians from surrounding him, at the same time he would be plentifully supplied with provisions from his ships. Of this advice Crassus seemed to approve; but was dissuaded by Abgarus king of Edessa, whom the Romans took for an ally, but who was in reality a traitor sent by Surenas to bring about the destruction of the Roman army.

Under the conduct of this faithless guide, the Romans entered a vast green plain divided by many rivulets. Their march proved very easy through this fine country; but the farther they advanced, the worse the roads became, insomuch that they were at last obliged to climb up rocky mountains, which brought them to a dry and sandy plain, where they could neither find food to satisfy their hunger, nor water to quench their thirst. Abgarus then began to be suspected by the tribunes and other officers, who earnestly entreated Crassus not to follow him any longer, but to retreat to the mountains; at the same time an express arrived from Artabazus, acquainting the Roman general that Orodes had invaded his dominions with a great army, and that he was obliged to keep his troops at home, in order to defend his own dominions. The same messenger advised Crassus in his master's name to avoid by all means the barren plains, where his army would certainly perish with hunger and fatigue, and by all means to approach Armenia, that they might join their forces against the common enemy. But all was to no purpose; Crassus, instead of hearkening either to the advice of the king or his own officers, first flew into a violent passion with the messengers of Artabazus, and then told his troops, that they were not to expect the delights of Campania in the most remote parts of the world.

Thus they continued their march for some days across a desert, the very sight of which was sufficient to throw them into the utmost despair: for they could not perceive, either near them or at a distance, the least tree, plant, or brook, not so much as a hill, or a single blade of grass; nothing was to be seen all around them but huge heaps of burning sand. The Romans had scarcely got through this desert, when word was brought them by their scouts, that a numerous army of Parthians was advancing full march to attack them; for Abgarus, under pretence of going out on parties, had often conferred with Surenas, and concerted measures with him for destroying the Roman army. Upon this advice, which occasioned great confusion in the camp, the Romans being quite exhausted, and tired out with their long and troublesome march, Crassus drew up his men in battalia, following at first the advice of Cassius, who was for extending the infantry as wide as possible, that they might take up the more ground, and by that means prevent the enemy from surrounding them: but Abgarus assuring the proconsul that the Parthian forces were not so numerous as was represented, he changed this disposition, and believing only the man who betrayed him, drew up his troops in a square, which faced every way, and had on each side 12 cohorts in front. Near each cohort he placed a troop of horse to support them, that they might charge with the greater security and boldness. Thus the whole army looked more like one phalanx than troops drawn up in manipuli, with spaces between them, after the Roman manner. The general himself commanded in the centre, his son in the left wing, and Cassius in the right.

11 The battle of Carrhæ.

In this order they advanced to the banks of a small river called the *Balissus*, the sight of which was very pleasing to the soldiers, who were much harassed with drought and excessive heat. Most of the officers were for encamping on the banks of this river, or rather rivulet, to give the troops time to refresh themselves after the fatigues of so long and painful a march; and, in the mean time to procure certain intelligence of the number and disposition of the Parthian army; but Crassus, suffering himself to be hurried on by the inconsiderate ardour of his son, and the horse he commanded, only allowed the legions to take a meal standing; and before this could be done by all, he ordered them to advance, not slowly, and halting now and then, after the Roman manner, but as fast as they could move, till they came in sight of the enemy, who, contrary to their expectation, did not appear either so numerous or so terrible as they had been represented; but this was a stratagem of Surenas, who had concealed his men in convenient places, ordering them to cover their arms, lest their brightness should betray them, and, starting up at the first signal, to attack the enemy on all sides. The stratagem had the desired effect; for Surenas no sooner gave the signal, than the Parthians, rising as it were out of the ground, with dreadful cries, and a most frightful noise, advanced against the Romans, who were greatly surprised and dismayed at the sight; and much more so, when the Parthians, throwing off the covering of their arms, appeared in shining cuirasses, and helmets of burnished steel, finely mounted on horses covered all over with armour of the same metal. At their head appeared young Surenas in a rich dress, who was the first who charged the enemy, endeavouring, with his pikemen, to break through the first ranks of the Roman army; but finding it too close and impenetrable, the cohorts supporting each other, he fell back, and retired in a seeming confusion: but the Romans were much surprised when they saw themselves suddenly surrounded on all sides, and galled with continual showers of arrows. Crassus ordered his light-armed foot and archers to advance, and charge the enemy; but they were soon repulsed, and forced to cover themselves behind the heavy-armed foot. Then the Parthian horse, advanced near the Romans, discharged showers of arrows upon them, every one of which did execution, the legionaries being drawn up in such close order, that it was impossible for the enemy to miss their aim. As their arrows were of an extraordinary weight, and discharged with incredible force and impetuosity, nothing was proof against them. The two wings advanced in good order to repulse them, but to no effect; for the Parthians shot their arrows with as great dexterity when their backs were turned, as when they faced the enemy; so that the Romans, whether they kept their ground, or pursued the flying enemy, were equally annoyed with their fatal arrows.

The Romans, as long as they had any hopes that the Parthians, after having spent their arrows, would either betake themselves to flight, or engage them hand to hand, stood their ground with great resolution and intrepidity; but when they observed that there were a great many camels in their rear loaded with arrows, and that those who emptied their quivers wheeled about to fill them anew, they began to lose courage, and loudly to complain of their general for suffering them thus to stand still, and serve only as a butt to the enemy's arrows, which, they well saw, would not be exhausted till they were all killed to a man. Hereupon Crassus ordered his son to advance, at all adventures, and attack the enemy with 1300 horse, 500 archers, and 8 cohorts. But the Parthians no sooner saw this choice body (for it was the flower of the army) marching up against them, than they wheeled about, and betook themselves, according to their custom to flight. Hereupon young Crassus, crying out as loud as he could, *They fly before us*, pushed on full speed after them, not doubting but he should gain a complete victory; but when he was at a great distance from the main body of the Roman army, he perceived his mistake; for those who before had fled, facing about, charged him with incredible fury. Young Crassus ordered his troops to halt, hoping that the enemy, upon seeing their small number, would not be afraid to come to a close fight: but herein he was likewise greatly disappointed; for the Parthians, contenting themselves to oppose his front with their heavy-armed horse, surrounded him on all sides; and, keeping at a distance, discharged incessant showers of arrows upon the unfortunate Romans, thus surrounded and pent up. The Parthian army, in wheeling about, raised so thick a dust, that the Romans could scarce see one another, much less the enemy: nevertheless, they found themselves wounded with arrows, though they could not perceive whence they came. In a short time the place where they stood was all strown with dead bodies.

12
Extreme distress of the Romans.

Some of the unhappy Romans finding their entrails torn, and many overcome by the exquisite torments they suffered, rolled themselves in the sand with the arrows in their bodies, and expired in that manner. Others endeavouring to tear out by force the bearded points of the arrows, only made the wounds the larger, and increased their pain. Most of them died in this manner; and those who outlived their companions were no more in a condition to act; for when young Crassus exhorted them to march up to the enemy, some showed him their wounded bodies, others their hands nailed to their bucklers, and some their feet pierced through and pinned to the ground; so that it was equally impossible for them either to attack the enemy or defend themselves. The young commander, therefore, leaving his infantry to the mercy of the enemy, advanced at the head of the cavalry against their heavy-armed horse. The thousand Gauls whom he had brought with him from the west, charged the enemy with incredible boldness and vigour; but their lances did little execution on men armed with cuirasses, and horses covered with tried armour: however, they behaved with great resolution; for some of them taking hold of the enemy's spears, and closing with them, threw them off their horses on the ground, where they lay without being able to stir, by reason of the great weight of their armour; others, dismounting, crept under the enemy's horses, and thrusting their swords into their bellies, made them throw their riders. Thus the brave Gauls fought, though greatly harassed with heat and thirst, which they were not accustomed to bear, till most of their horses were killed, and their commander dangerously wounded. They then thought it adviseable to retire to their infantry, which they no sooner joined, than the Parthians invested them anew, making a most dreadful havock of them with their arrows. In this desperate condition, Crassus, spying a rising ground at a small distance, led the remains of his detachment thither, with a design to defend himself in the best manner he could, till succours should be sent him from his father. The Parthians pursued him; and having surrounded him in his new post, continued showering arrows upon his men, till most of them were either killed or disabled, without being able to make use of their arms, or give the enemy proofs of their valour.

Young Crassus had two Greeks with him, who had settled in the city of Carrhæ. These, touched with compassion, at seeing so brave a man reduced to such straits, pressed him to retire with them to the neighbouring city of Ischnes, which had declared for the Romans; but the young Roman rejected their proposal with indignation, telling them, that he would rather die a thousand times than abandon so many valiant men, who sacrificed their lives for his sake. Having returned this answer to his two Greek friends, he embraced and dismissed them, giving them leave to retire and shift for themselves in the best manner they could. As for himself, having now lost all hopes of being relieved, and seeing most of his men and friends killed round him, he gave way to his grief; and, not being able to make use of his arm, which was shot through with a large barbed arrow, he presented his side to one of his attendants, and ordered him to put an end to his unhappy life. His example was followed by Censorius a senator, by Megabacchus an experienced and brave officer, and by most of the nobility who served under him. Five hundred common soldiers were taken prisoners, and the rest cut in pieces.

13
The dea
of young
Crassus.

The Parthians, having thus cut off or taken the whole detachment commanded by young Crassus, marched without delay against his father, who, upon the first advice that the enemy fled before his son, and were closely pursued by him, had taken heart, the more because those who had remained to make head against him seemed to abate much of their ardour, the greatest part of them having marched with the rest against his son. Wherefore, having encouraged his troops, he had retired to a small hill in his rear, to wait there till his son returned from the pursuit. Young Crassus had despatched frequent expresses to his father, to acquaint him with the danger he was in; but they had fallen into the enemy's hands, and been by them put to the sword: only the last, who had escaped with great difficulty, arrived safe, and informed him that his son was lost if he did not send him an immediate and powerful reinforcement. This news threw Crassus into the utmost consternation; a thousand affecting thoughts rose in his mind, and disturbed his reason to such a degree, that he scarce knew what he was doing. However, the desire he had of saving his son, and so many brave Romans who were under his command, made him immediately decamp, and march to their assistance; but he was not gone far before he was met by the Parthians, who, with loud shouts, and songs of victory, gave, at a distance, the unhappy father notice of his misfortune. They had cut off young Crassus's head, and, having fixed it on the point of a lance, were advancing full speed to fall on the father. As they drew near, Crassus was struck with that dismal and affecting sight; but on this occasion, behaved like a hero: for though he was under the deepest concern, he had the presence of mind to stifle his grief, for fear of discouraging the army, and to cry out to the dismayed troops, "This misfortune is entirely mine; the loss of one man cannot affect the victory: Let us charge, let us fight like Romans: if you have any compassion for a father who has just now lost a son whose valour you admired, let it appear in your rage and resentment against these insulting barbarians." Thus Crassus strove to reanimate his troops; but his efforts were unsuccessful: their courage was quite sunk, as appeared from the faint and languishing shout which they raised, according to custom, before the action. When the signal was given, the Parthians, keeping to their old way of fighting, discharged clouds of arrows on the legionaries, without drawing near them; which did such dreadful execution, that many of the Romans, to avoid the arrows, which occasioned a long and painful death, threw themselves, like men in despair, on the enemy's heavy-armed-horse, seeking from their spears a more quick and easy kind of death. Thus the Parthians continued plying them incessantly with their arrows till night, when they left the field of battle, crying out, that they would allow the father one night to lament the death of his son.

14
Distress of Crassus.

This was a melancholy night for the Romans. Crassus kept himself concealed from the soldiery, lying not in the general's tent, but in the open air, and on the bare ground, with his head wrapped up in his paludamentum or military cloak; and was, in that forlorn condition, says Plutarch, a great example to the vulgar, of the instability of fortune; to the wise, a still greater of the pernicious effects of avarice, temerity, and ambition. Octavius, one of his lieutenants, and Cassius, approached him, and endeavoured to raise him up and console him: but, seeing him quite sunk under the weight of his affliction, and deaf to all comfort, they summoned a council of war, composed of all the chief officers; wherein it was unanimously resolved, that they should decamp before break of day, and retire, without sound of trumpet, to the neighbouring city of Carrhæ, which was held by a Roman garrison. Agreeable to this resolution, they began their march as soon as the council broke up; which produced dreadful outcries among the sick and wounded, who, perceiving that they were to be abandoned to the mercy of the enemy, filled the camp with their complaints and lamentations: but their cries and tears, though very affecting, did not stop the march of the others, which, indeed, was very slow, to give the stragglers time to come up. There were only 300 light horse, under the command of one Ægnatius, who pursued their march without stopping. These arriving at Carrhæ about midnight, Ægnatius, calling to the centinels on the walls, desired them to acquaint Coponius, the governor of the place, that Crassus had fought a great battle with the Parthians; and, without saying a word more, or letting him know who he was, continued his march with all possible expedition to the bridge of Zeugma; which he passed, and by that means saved his troops, but was much blamed for thus abandoning his general.

The message which he sent to Coponius was of some temporary service to Crassus. For that commander, wisely conjecturing, from the manner in which the unknown person had given him the intelligence, that some misfortune had befallen Crassus, immediately ordered his garrison to stand to their arms; and, marching out, met Crassus, and conducted him and his army into the city: for the Parthians, though informed of his flight, did not offer to pursue him, observing therein the superstitious custom which obtained among them and the Persians, not to fight in the night; but when it was day, they entered the Roman camp, and having put all the wounded, to the number of 4000, to the sword, dispersed their cavalry all over the plain, in pursuit of the fugitives. One of Crassus's lieutenants, named *Vargunteius*, having separated in the night from the main body of the army, with four cohorts, missed his way, and was overtaken by the enemy; at whose approach he withdrew to a neighbouring hill, where he defended himself, with great valour, till all his men were killed, except 20, who made their way through the enemy, sword in hand, and got safe to Carrhæ: but Varguntеius himself lost his life on the occasion.

15
Surenas pretends to confer with Crassus.

In the mean time Surenas, not knowing whether Crassus and Cassius had retired to Carrhæ, or chosen a different route; in order to be informed of the truth, and take his measures accordingly, despatched a messenger, who spoke the Roman language, to the city of Carrhæ, enjoining him to approach the walls, and acquaint Crassus himself, or Cassius, that the Parthian general was inclined to enter into a treaty with them, and demanded a conference. Both the proconsul and his quæstor Cassius spoke from the walls with the messenger; and, accepting the proposal with great joy, desired that the time and place for an interview might be immediately agreed upon. The messenger withdrew, promising to return quickly with an answer from Surenas: but that general no sooner understood that Crassus and Cassius were in Carrhæ, than he marched thither with his whole army; and, having invested the place, acquainted the Romans, that if they expected any favourable terms, they must deliver up Crassus and Cassius to him in chains. Hereupon a council of the chief officers being summoned, it was thought expedient to retire from Carrhæ that very night, and seek for another asylum. It was of the utmost importance that none of the inhabitants of Carrhæ should be acquainted with their design till the time of its execution; but Crassus, whose whole conduct evidently shows that he was blinded, as Dio Cassius observes, by some divinity, imparted the whole matter in confidence to one Andromachus, choosing him for his guide, and relying injudiciously on the fidelity of a man whom he scarce knew. Andromachus immediately acquainted Surenas with the design of the Romans; promising at the same time, as the Parthians did not engage in the night, to manage matters so, that they should not get out of his reach before daybreak. Pursuant to his promise, he led them through many windings and turnings, till he brought them into deep marshy grounds where the infantry were up to the knees in mire. Then Cassius, suspecting that their guide had led them into those bogs with no good design, refused to follow him any longer; and returning to Carrhæ, took his route towards Syria, which he reached with 500 horse. Octavius, with 5000 men under his command, being conducted by trusty guides, gained the mountains called by Plutarch and Appian *Sinnaci*, and there intrenched himself before break of day.

As for Crassus, he was still entangled in the marshes, when Surenas, at the rising of the sun, overtook him, and invested him with his cavalry. The proconsul had with him four cohorts, and a small body of horse; and with these he gained, in spite of all opposition, the summit of another hill within 12 furlongs of Octavius; who seeing the danger that threatened his general, flew to his assistance, first with a small number of his men, but was soon followed by all the rest, who, being ashamed of their cowardice, quitted their post, though very safe, and charging the Parthians with great fury, disengaged Crassus, and obliged the enemy to abandon the hill. Upon the retreat of the enemy, they formed themselves into a hollow square; and placing Crassus in the middle, made a kind of rampart round him with their bucklers, resolutely protesting, that none of the enemy's arrows should touch their general's body, till they were all killed fighting in his defence. Surenas, loth to let so fine a prey escape, surrounded the hill, as if he designed to make a new attack: but, finding his Parthians very backward, and not doubting but the Romans, when night came on, would pursue their march, and get out of his reach, he had recourse again to artifice; and declared before some prisoners, whom he soon after set at liberty, that he was inclined to treat with the proconsul of a peace; and that it was better to come to a reconciliation with Rome, than to sow the seeds of an eternal war, by shedding the blood of one of her generals.

Agreeable to this declaration, Surenas, as soon as the prisoners were released, advanced towards the hill where the Romans were posted, attended only by some of his officers, and, with his bow unbent, and open arms, invited Crassus to an interview. So sudden a change seemed very suspicious to the proconsul; who therefore declined the interview, till he was forced, by his own soldiers, to intrust his life with an enemy whose treachery they had all experienced; for the legionaries flocking round him, not only abused him in an outrageous manner, but even menaced him if he did not accept of the proposals made him by the Parthian general. Seeing, therefore, that his troops were ready to mutiny, he began to advance, without arms or guards, towards the enemy, after having called the gods and his officers to witness the violence his troops offered him; and intreated all who were present, but especially Octavius and Petronius, two of the chief commanders, for the honour of Rome their common mother, not to mention, after his death, the shameful behaviour of the Roman legionaries. Octavius and Petronius could not resolve to let him go alone; but attended him down the hill, as did likewise some legionaries, keeping at a distance. Crassus was met at the foot of the hill by two Greeks who, dismounting from their horses, saluted him with great respect; and desired him in the Greek tongue, to send some of his attendants, who might satisfy him that Surenas, and those who were with him, came without arms. Hereupon Crassus sent two brothers, of the Roscian family; but Surenas having caused them to be seized, advanced to the foot of the hill, mounted on a fine horse, and attended by the chief officers of his army. Crassus, who waited for the return of his two messengers, was surprised to see himself prevented by Surenas in person, when he least expected it. The Parthian general, perceiving, as he approached Crassus, that he was on foot, cried out, in a seeming surprise, "What do I see? a Roman general on foot, and we on horseback! Let a horse be brought for him immediately." "You need not be surprised (replied Crassus): we are come only to an interview, each after the custom of his country." "Very well (answered Surenas), there shall be henceforth a lasting peace between King Orodes and the people of Rome: but we must sign the articles of it on the banks of the Euphrates; for you Romans do not always remember your conventions." Crassus would have sent for a horse; but a very stately one with a golden bit, and richly caparisoned, was brought to him by a Parthian; which Surenas presenting to him, "Accept this horse from my hands (said he), which I give you in the name of my master King Orodes." He had scarce uttered these words, when some of the king's officers, taking Crassus by the middle, set him upon the horse, which they began to whip with great violence before them in order to make him quicken his pace. Octavius, offended at this insult, took the horse by the bridle; Petronius and the few Romans who were present, seconded him, and flocking all round Crassus, stopped his horse. The Parthians endeavoured to repulse them, and clear the way for the proconsul; whereupon they began to justle and push one another with great tumult and disorder. At last, Octavius, drawing his sword, killed one of the king's grooms; but, at the same time, another coming behind Octavius, with one blow laid him dead at his feet. Both parties fought with great resolution, the Parthians striving to carry off Crassus, and the Romans to rescue him out of their hands. In this scuffle most of the Romans who came to the conference were killed; and amongst the rest Crassus himself; but whether by a Roman or a Parthian is uncertain. 16 Crassus killed.

Upon his death, the rest of the army either surrendered to the enemy, or dispersing in the night, were pursued, and put to the sword. The Romans lost in this campaign at least 30,000 men; of which 20,000 were killed, and 10,000 taken prisoners.

When the battle of Carrhæ was fought, King Orodes was in Armenia, where he had made peace with Artabazus. While the two kings were solemnizing their new alliance with expensive and public feasts, Styllaces or Syllaces, a Parthian officer, whom Surenas had sent with the news of his late victory, and the head of Crassus as a proof it, arrived in the capital of Armenia. The transports of joy which Orodes felt at this sight, and these news, are not to be expressed; and the lords of both kingdoms, who attended their sovereigns, raised loud and repeated shouts of joy. Syllaces was ordered to give a more particular and distinct account of that memorable action; which when he had done, Orodes commanded melted gold to be poured into Crassus's mouth; reproaching him thereby with avarice, which had been always his predominant passion.

17 Surenas put to death by Orodes. Surenas did not long enjoy the pleasure of his victory; for Orodes, jealous of his power and authority among the Parthians, soon after caused him to be put to death. Pacorus, the king's favourite son was put at the head of the army; and, agreeably to his father's directions, invaded Syria: but he was driven out from thence with great loss by Cicero and Cassius, the only general who survived the defeat of Crassus. After this we find no

mention of the Parthians, till the time of the civil war between Cæsar and Pompey, when the latter sent ambassadors to solicit succour against his rivals. This Orodes was willing to grant upon condition that Syria was delivered up to him; but as Pompey would not consent to such a proposal, the succours were not only denied, but, after the battle of Pharsalia, he put Lucius Hirtius in irons, whom Pompey had again sent to ask assistance, or at least to desire leave to shelter himself in the Parthian dominions.

18
War commenced against the Parthians by Mark Antony.

Cæsar is said to have meditated a war against the Parthians, which in all probability would have proved fatal to them. His death delivered them from this danger. But, not long after, the eastern provinces, being grievously oppressed by Mark Antony, rose up in arms; and having killed the tax-gatherers, invited the Parthians to join them and drive out the Romans. They very readily accepted the invitation, and crossed the Euphrates with a powerful army under the command of Pacorus, and Labienus a Roman general of Pompey's party. At first they met with great success, overran all Asia Minor, and reduced all the countries as far as the Hellespont and the Egæan sea, subduing likewise Phœnicia, Syria, and even Judea. They did not however long enjoy their new conquests: for being elated with their victories, and despising the enemy, they engaged Ventidius, Antony's lieutenant, before Labienus had time to join them, and were utterly defeated. This so disheartened Labienus's army, that they all abandoned him; and he himself, being thus obliged to wander from place to place in disguise, was at last taken and put to death at Cyprus. Ventidius pursuing his advantage, gained several other victories; and at last entirely defeated the Parthian army under Pacorus, cutting almost the whole of them in pieces, and the prince himself among the rest. He did not, however, pursue this last victory as he might have done; being afraid of giving umbrage to Antony, who had already become jealous of the great honour gained by his lieutenant. He therefore contented himself with reducing those places in Syria and Phœnicia which the Parthians had taken in the beginning of the war, until Antony arrived to take the command of the army upon himself.

19
Pacorus defeated and killed by Ventidius.

Orodes was almost distracted with grief on receiving the dreadful news of the loss of his army and the death of his favourite son. However, when time had restored the use of his faculties, he appointed Phrahates, the eldest but the most wicked, of all his children, to succeed him in the kingdom, admitting him at the same time to a share of the sovereign authority with himself. The consequence of this was, that Phrahates very soon attempted to poison his father with hemlock. But this, contrary to expectation, proving a cure for the dropsy, which an excess of grief had brought upon the king, the unnatural son had him stifled in bed, and soon after not only murdered all his own brethren, who were thirty in number, but cut off all the rest of the royal family, not sparing even his own eldest son, lest the discontented Parthians should place him, as he was already of age, on the throne.

20
Orodes murdered.

Many of the chief lords of Parthia being intimidated by the cruelty of Phrahates, retired into foreign countries: and among those one Monœses, a person of great distinction, as well as skill and experience in war. This man, having fled to Antony, soon gained his confidence, and was by him easily prevailed upon to engage in a war against his countrymen. But Phrahates justly dreading the consequences of such a person's defection, sent a solemn embassy to invite him home on such terms as he should think fit to accept; which greatly provoked Antony; though he did not hinder him from returning, lest others should thereby be discouraged from coming over to him. He therefore dismissed him with great civility, sending ambassadors at the same time to Phrahates to treat of a peace. Thus he hoped to divert the Parthian monarch's attention from making the necessary preparations for war, and that he should be able to fall upon him in the spring when he was in no condition to make resistance. But herein he was greatly disappointed; for on his arrival at the Euphrates, which he intended to pass, and enter the Parthian dominions on that side, he found all the passes so well guarded, that he thought proper to enter Media with a design first to reduce that country, and then to enter Parthia.

21
Antony betrayed by Artabazus king of Armenia.

This plan had been suggested to him by Artabazus king of Armenia, who in the end betrayed him; for instead of conducting the army the straight way from Zeugma on the Euphrates, to the Araxes which parted Media from Armenia, and which was about 500 miles distant from the place whence he first set out, Artabazus led them over the rocks and mountains so far about, that the army had marched above 1000 miles before they reached the borders of Media, where they intended to begin the war. Thus they were not only greatly fatigued but had not sufficient time, the year being far spent, to put in execution the design on which they had come. However, as Antony was impatient to get back to Cleopatra, he left behind him most of the baggage of the army, and 300 waggons loaded with battering rams and other military engines for sieges; appointing Statianus, one of his lieutenants, with a body of 10,000 men, to guard them, and to bring them, by slow marches, after the army. With the rest of the forces he marched more than 300 miles before the rest, without allowing his men any respite till he arrived at Praaspa or Phrahata, the capital of Media, which he immediately invested. But the Parthians, well knowing that he could not make any progress without his military machines, passed by his army, in order to attack Statianus; which they did with such success, that the body commanded by him were all to a man cut off, and all their military engines taken, among which was a battering ram 80 feet long.

22
Ten thousand Romans cut off.

Antony, notwithstanding this disaster, continued the siege of Praaspa; but was daily harassed by sallies of the garrison from within, and the enemy's army without. At last he began to think of a retreat when his provisions were almost exhausted, finding it impossible to become master of the city. But as he was to march 300 miles through the enemy's country, he thought proper first to send ambassadors to the Parthian monarch, acquainting him that the Roman people were willing to allow him a peace, provided he would restore the standards and prisoners taken at Carrhæ. Phrahates received the ambassadors, sitting on a golden throne; and, after having bitterly inveighed against the avarice and unbounded ambitition of the Romans, told them that he would not part with the standards and prisoners; but that if Antony would immediately raise the siege of Praaspa, he would suffer him to retire unmolested.

Antony, who was reduced to great straits, no sooner
received

23 Antony leaves Parthia in great distress.

received this answer than he broke up the siege, and marched towards Armenia. However, Phrahates was not so good as his word; for the Romans were attacked by the enemy no fewer than 18 times on their march, and were thrice in the utmost danger of being cut off. A famine also raged in the Roman army; upon which they began to desert to the enemy; and indeed Antony would probably have been left by himself, had not the Parthians, in a very cruel as well as impolitic manner, murdered all those who fled to them in sight of the rest. At last, after having lost 32,000 men, and being reduced to such despair that he was with difficulty prevented from laying violent hands on himself, he reached the river Araxes; when his men, finding themselves out of the reach of the enemy, fell down on the ground, and kissed it with tears of joy.

Antony was no sooner gone, than the kings of Media and Parthia quarrelled about the booty they had taken; and after various contests Phrahates reduced all Media and Armenia. After this, being elated with his conquests, he oppressed his subjects in such a cruel and tyrannical manner, that a civil war took place; in which the competitors were alternately driven out and restored, till the year 50, when one Vologeses, the son of Gortarzes, a former king, became peaceable possessor of the throne. He carried on some wars against the Romans, but with very indifferent success, and at last gladly consented to a renewal of the ancient treaties with that powerful people.

24 Parthia subdued by Trajan.

From this time the Parthian history affords nothing remarkable till the reign of the emperor Trajan; when the Parthian king, by name *Cosdroes*, infringed the treaty with Rome, by driving out the king of Armenia. Upon this Trajan, who was glad of any pretence to quarrel with the Parthians, immediately hastened into Armenia. His arrival there was so sudden and unexpected, that he reduced almost the whole country without opposition; and took prisoner Parthamasiris, the king whom the Parthians had set up. After this he entered Mesopotamia, took the city of Nisibis, and reduced to a Roman province the whole of that wealthy country.

Early in the spring of the following year, Trajan, who had kept his winter quarters in Syria, took the field again; but was warmly opposed by Cosdroes.—He found him encamped on the banks of the Euphrates, with a design to dispute his passage; which he did with such vigour, that the emperor, after having several times attempted to ford that river, and been always repulsed with great slaughter, was obliged to cause boats to be built on the neighbouring mountains, which he privately conveyed from thence on carriages to the water side; and having in the night time formed a bridge with them, he passed his army the next day; but not without great loss and danger, the Parthians harassing his men the whole time with incessant showers of arrows, which did great execution. Having gained the opposite bank, he advanced boldly into Assyria, the Parthians flying everywhere before him, and made himself master of Arbela. Thence he pursued his march; subduing, with incredible rapidity, countries where the Roman standard had never been before displayed. Babylonia, or the province of Babylon, voluntarily submitted to him. The city itself was, after a vigorous resistance, taken by storm; by which means he became master of all Chaldea and Assyria, the two richest provinces of the Parthian empire. From Babylon he marched to Ctesiphon, the metropolis of the Parthian monarchy; which he besieged, and at last reduced. But as to the particulars of these great conquests, we are quite in the dark; this expedition, however glorious to the Roman name, being rather hinted at than described, by the writers of those times. While Trajan was thus making war in the heart of the enemy's country, Cosdroes, having recruited his army, marched into Mesopotamia, with a design to recover that country, and cut off all communication between the Roman army and Syria. On his arrival in that province, the inhabitants flocked to him from all parts; and most of the cities, driving out the garrisons left by Trajan, opened their gates to him. Hereupon the emperor detached Lucius and Maximus, two of his chief commanders, into Mesopotamia, to keep such cities in awe as had not revolted, and to open a communication with Syria. Maximus was met by Cosdroes; and having ventured a battle, his army was entirely defeated, and himself killed. But Lucius being joined by Euricius and Clarius, two other commanders sent by Trajan with fresh supplies, gained considerable advantages over the enemy, and retook the cities of Nisibis and Seleucia, which had revolted.

And now Trajan, seeing himself possessed of all the best and most fruitful provinces of the Parthian empire, but at the same time being well apprised that he could not, without a vast expence, maintain his conquests, nor keep in subjection so fierce and warlike a people at such a distance from Italy; resolved to set over them a king of his own choosing, who should hold the crown of him and his successors, and acknowledge them as his lords and sovereigns. With this view he repaired to Ctesiphon; and having there assembled the chief men of the nation, he crowned one of the royal family, by name *Parthanaspates*, king of Parthia, obliging all who were present to pay him their allegiance. He chose Parthanaspates, because that prince had joined him at his first entering the Parthian dominions, conducted him with great fidelity, and shown on all occasions an extraordinary attachment to the Romans. Thus the Parthians were at last subdued, and their kingdom made tributary to Rome. But they did not long continue in this state of subjection: for they no sooner heard of Trajan's death, which happened shortly after, than, taking up arms, they drove Parthanaspates from the throne; and recalling Cosdroes, who had retired into the country of the Hyrcanians, openly revolted from Rome. Adrian, who was then commander in chief of all the forces in the east, and soon after acknowledged emperor by the army, did not wish, though he was at that time in Syria with a very numerous army, to engage in a new war with the Parthians; but contented himself with preserving the ancient limits of the empire, without any ambitious prospects of further conquests. Therefore, in the beginning of his reign, he abandoned those provinces beyond the Euphrates which Trajan had conquered; withdrew the Roman garrisons from Mesopotamia; and, for the greater safety of other places, made the Euphrates the boundary of, and barrier in, those parts, posting his legions along the banks of that river.

25 Parthanaspates appointed king by the Roman emperor, but soon after driven out.

26 Unsuccessful wars of Vologeses with the Romans.

Cosdroes died after a long reign, and was succeeded by his eldest son Vologeses: in whose reign the Alani breaking into Media, then subject to the Parthians, committed there great devastations; but were prevailed upon, with rich presents sent them by Vologeses, to abandon that kingdom, and return home. Upon their retreat, Vologeses, having no enemy to contend with at home, fell unexpectedly upon Armenia; surprised the legions there; and having cut them all in pieces to a man, entered Syria; defeated with great slaughter Attilius Cornelianus, governor of that province; and advanced without opposition to the neighbourhood of Antioch; putting everywhere the Romans, and those who favoured them, to the sword. Hereupon the emperor Verus, by the advice of his colleague Antoninus surnamed the *Philosopher*, leaving Rome, hastened into Syria: and having driven the Parthians out of that province, ordered Statius Priscus to invade Armenia, and Cassius with Martius Verus to enter the Parthian territories, and carry the war into the enemy's country. Priscus made himself master of Artaxata; and in one campaign drove the Parthians, though not without great loss on his side, quite out of Armenia. Cassius, on the other hand, having in several encounters defeated Vologeses, though he had an army of 400,000 men under his command, reduced, in four years time, all those provinces which had formerly submitted to Trajan, took Seleucia, burnt and plundered the famous cities of Babylon and Ctesiphon, with the stately palaces of the Parthian monarchs, and struck terror into the most remote provinces of that great empire. On his return, he lost above half the number of his forces by sickness and famine; so that, after all, the Romans, as Spartianus observes, had no great reason to boast of their victories and conquests.

However, Verus, who had never stirred during the whole time of the war from Antioch and Daphne, took upon him the lofty titles of *Parthicus* and *Armenicus*, as if he had acquired them justly in the midst of his pleasures and debaucheries. After the revolt and death of Cassius, Antoninus the Philosopher repaired into Syria to settle the affairs of that province. On his arrival there, he was met by ambassadors from Vologeses; who having recovered most of the provinces subdued by Cassius, and being unwilling either to part with them or engage in a new war, solicited the emperor to confirm him in the possession of them, promising to hold them of him, and to acknowledge the sovereignty of Rome. To these terms Antoninus readily agreed, and a peace was accordingly concluded between the two empires; which Vologeses did not long enjoy, being soon after carried off by a distemper, and not murdered by his own subjects, as we read in Constantinus Manasses, who calls him *Belegeses*.

27
Ctesiphon taken by Severus.

Upon his death, Vologeses III. the son of his brother Sanatruces, and grandson of Cosdroes, was raised to the throne. He sided with Niger against the emperor Severus: who thereupon having settled matters at home, marched with all his forces against him; and advancing to the city of Ctesiphon, whither he had retired, laid close siege to that metropolis. Vologeses made a most gallant defence: but the city, after a long siege, and much bloodshed on both sides, was at length taken by assault. The king's treasures, with his wives and children, fell into the emperor's hands; but Vologeses himself had the good luck to make his escape; which was a great disappointment to Severus, who immediately despatched an express to acquaint the senate with the success that had attended him in his expedition against the only nation that was then formidable to Rome. But he had no sooner crossed the Euphrates than Vologeses recovered all the provinces except Mesopotamia, which he had reduced. These expeditions were chargeable to the Romans, and cost them much blood, without reaping any advantages from them; for as they had not sufficient forces to keep in awe the provinces they had subdued, the inhabitants, greatly attached to the family of Arsaces, never failed to return to their ancient obedience as soon as the Roman armies were withdrawn. Vologeses was soon after engaged in a war still more troublesome and destructive, with his brother Artabanus, who, encouraged by some of the discontented nobles, attempted to rob him of the crown, and place it on his own head. Vologeses gained several victories over his brother and rebellious subjects; but died before he could restore the empire to its former tranquillity.

Artabanus, who had a numerous army at his devotion, did not meet with any opposition in seizing the throne, vacant by the death of his brother, though Tiridates had a better tittle to it, as being his elder brother. He had scarce settled the affairs of his kingdom, when the emperor Caracalla, desirous to signalize himself as some of his predecessors had done, by some memorable exploit against the Parthians, sent a solemn embassy to him, desiring his daughter in marriage. Artabanus, overjoyed at this proposal, which he thought would be attended with a lasting peace between the two empires, received the ambassadors with all possible marks of honour, and readily complied with their request. Soon after, Caracalla sent a second embassy to acquaint the king that he was coming to solemnize the nuptials; whereupon Artabanus went to meet him, attended with the chief of the nobility and his best troops, all unarmed, and in most pompous habits: but this peaceable train no sooner approached the Roman army, than the soldiers, on a signal given them, falling upon the king's retinue, made a most terrible slaughter of the unarmed multitude, Artabanus himself escaping with great difficulty. The treacherous Caracalla, having gained by this exploit great booty, and, as he thought, no less glory, wrote a long and boasting letter to the senate, assuming the title of *Parthicus* for this piece of treachery; as he had before that of *Germanicus*, for murdering, in like manner, some of the German nobility.

28
Infamous treachery of the emperor Caracalla.

Artabanus, resolving to make the Romans pay dear for their inhuman and barbarous treachery, raised the most numerous army that had ever been known in Parthia, crossed the Euphrates, and entered Syria, putting all to fire and sword. But Caracalla being murdered before this invasion, Macrinus, who had succeeded him, met the Parthians at the head of a mighty army, composed of many legions, and all the auxiliaries of the states of Asia. The two armies no sooner came in sight of each other, but they engaged with the utmost fury. The battle continued two days; both Romans and Parthians fighting so obstinately, that night only parted them, without any apparent advantage on either side; though both retired when night had put an end to the contest, crying, Victory, victory. The field of battle was covered all over with dead bodies, there being already above 40,000 killed, including both Romans and Parthians: nevertheless Artabanus,

29
A desperate battle between the Parthians and Romans.

Artabanus was heard to say, that the battle was only begun, and that he would continue it till either the Parthians or Romans were all to a man cut in pieces. But Macrinus, being well apprised that the king came highly enraged against Caracalla in particular, and dreading the consequences which would attend the destruction of his army, sent a herald to Artabanus, acquainting him with the death of Caracalla, and proposing an alliance between the two empires. The king, understanding that his great enemy was dead, readily embraced the proposals of peace and amity, upon condition that all the prisoners who had been taken by the treachery of Caracalla should be immediately restored, and a large sum of money paid him to defray the expences of the war.

These articles being performed without delay or hesitation, Artabanus returned into Parthia, and Macrinus to Antioch.

30
The Persians revolt and overthrow the Parthian empire.

As Artabanus lost on this occasion the flower of his army, Artaxerxes, a Persian of mean descent, but of great courage and experience in war, revolting from the Parthians, prevailed on his countrymen to join him, and attempt the recovery of the sovereign power, which he said they had been unjustly deprived of, first by the Macedonians, and afterwards by the Parthians, their vassals. Artabanus, upon the news of this revolt, marched with the whole strength of his kingdom to suppress it; but being met by Artaxerxes at the head of a no less powerful army, a bloody battle ensued, which is said to have lasted three days. At length the Parthians, though they behaved with the utmost bravery, and fought like men in despair, were forced to yield to the Persians, who were commanded by a more experienced leader. Most of their troops were cut off in the flight; and the king himself was taken prisoner, and soon after put to death at Artaxerxes's order. The Parthians having lost in this fatal engagement both their king and their army, were forced to submit to the conqueror, and become vassals to a nation which had been subject to them for the space of 475 years.

For an account of the manners, customs, &c. of the ancient Parthians, see the article PERSIA.

PARTI, PARTIE, *Party*, or *Parted*, in *Heraldry*, is applied to a shield or escutcheon, denoting it divided or marked out into partitions.

PARTI *per pale*, is when the shield is divided perpendicularly into two halves, by a cut in the middle from top to bottom.

PARTI *per fess*, is when the cut is across the middle from side to side.

PARTI *per bend dexter*, is when the cut comes from the upper corner of the shield on the right hand, and descends athwart to the opposite lower corner.

PARTI *per bend sinister*, is when the cut, coming from the upper left corner, descends across to the opposite lower one.

All these partitions, according to M. de la Colombiere, have their origin in the cuts and bruises that have appeared on shields after engagements; and being proofs of the dangers to which the bearers had been exposed, they gained them esteem; for which reason they were transmitted to posterity, and became arms and marks of honour to their future families.

PARTIALITY. See *SELF-partiality* and PREJUDICE.

PARTICIPLE, in *Grammar*, an adjective formed of a verb; so called because it participates partly of the properties of a noun, and partly of those of a verb. See GRAMMAR.

PARTICLE, in *Physics*, the minute part of a body, an assemblage of which constitutes all natural bodies.

In the new philosophy, particle is often used in the same sense with atom in the ancient Epicurean philosophy, and corpuscle in the later. Some writers, however, distinguish them; making particle an assemblage or composition of two or more primitive and physically indivisible corpuscles or atoms; and corpuscle, or little body, an assemblage or mass of several particles or secondary corpuscles. The distinction, however, is of little moment; and, as to most purposes of physics, particle may be understood as synonymous with corpuscle. Particles are then the elements of bodies: it is the various arrangement and texture of these, with the difference of the cohesion, &c. that constitute the various kinds of bodies, hard, soft, liquid, dry, heavy, light, &c. The smallest particles or corpuscles cohere, with the strongest attractions, and always compose larger particles of weaker cohesion; and many of these cohering compose larger particles, whose vigour is still weaker; and so on for divers successions, till the progression end in the largest particles, on which the operations in chemistry, and the colours of natural bodies, depend, and which, by cohering, compose bodies of sensible bulks.

The cohesion of the particles of matter, according to the Epicureans, was effected by hooked atoms; the Aristotelians thought it managed by rest, that is, by nothing at all. But Sir Isaac Newton shows it is by means of a certain power whereby the particles mutually attract or tend toward each other, which is still perhaps giving a fact without a cause. By this attraction of the particles he shows that most of the phenomena of the lesser bodies are effected, as those of the heavenly bodies are by the attraction of gravity. See ATTRACTION and COHESION.

PARTICLE, a term in *Theology*, used in the Latin church for the crumbs or little pieces of consecrated bread, called in the Greek church μεριδες. The Greeks have a particular ceremony, called των μεριδων, *of the particles*, wherein certain crumbs of bread, not consecrated, are offered up in honour of the Virgin, St John Baptist, and several other saints. They also give them the name of προσφορα, *oblatio*. Gabriel archbishop of Philadelphia wrote a little treatise express περι των μεριδων, wherein he endeavours to show the antiquity of this ceremony, in that it is mentioned in the liturgies of St Chrysostom and Basil. There has been much controversy on this head between the reformed and catholic divines. Aubertin and Blondel explain a passage in the theory of Germanus patriarch of Constantinople, where he mentions the ceremony of the particles as in use in his time, in favour of the former; Messieurs de Port Royal contest the explanation; but M. Simon, in his notes on Gabriel of Philadelphia, endeavours to show that the passage itself is an interpolation, not being found in the ancient copies of Germanus, and consequently that the dispute is very ill grounded.

Organic PARTICLES, are those small moving bodies which are imperceptible without the help of glasses; for besides those animals which are perceptible to the sight, some naturalists reckon this exceedingly small species as a separate class, if not of animals properly so called, at least of moving bodies, which are found in the semen of animals, and which cannot be seen without the help of the microscope. In consequence of these observations, different systems of generation have been proposed concerning the spermatic worms of the male and the eggs of the female. In the second volume of Buffon's Natural History, several experiments are related, tending to show that those moving bodies which we discover by the help of glasses in the male semen are not real animals, but organic, lively, active, and indestructible molecules, which possess the property of becoming a new organized body similar to that from which they were extracted. Buffon found such bodies in the female as well as in the male semen; and he supposes that the moving bodies which he observed with the microscope in infusions of the germs of plants are likewise vegetable organic molecules. Needham, Wrisberg, Spalanzani, and several other writers on the animal economy, have pursued the same track with M. de Buffon.

Some suppose that these organic molecules in the semen answer no purpose but to excite the venereal desire: but such an opinion cannot be well founded; for eunuchs, who have no seminal liquor, are nevertheless subject to venereal desire. With respect to the beautiful experiments which have been made with the microscope on organic molecules, M. Bonnet, that learned and excellent observer of nature, remarks that they seem to carry us to the farthest verge of the sensible creation, did not reason teach us that the smallest visible globule of seminal liquor is the commencement of another universe, which, from its infinite smallness, is beyond the reach of our best microscopes.—*Animalcules*, properly so called, must not be confounded with the wonderful organic particles of Buffon. See ANIMALCULE.

PARTICLE, in *Grammar*, a denomination for all those small words that tie or unite others, or that express the modes or manners of words. See GRAMMAR.

PARTING, in *Chemistry* and *Metallurgy*, an operation by which gold and silver are separated from each other. See CHEMISTRY, and *ORES, Reduction of*.

PARTISAN, in the art of war, a person dexterous in commanding a party; who, knowing the country well, is employed in getting intelligence, or surprising the enemy's convoys, &c. The word also means an officer sent out upon a party, with the command of a body of light troops, generally under the appellation of the partisan's corps. It is also necessary that this corps should be composed of infantry, light horse, and hussars.

PARTNERSHIP, is a contract among two or more persons, to carry on a certain business, at their joint expence, and share the gain or loss which arises from it. Of this there are four kinds.

I. Occasional joint trade, where two or more merchants agree to employ a certain sum in trade, and divide the gain or loss so soon as the adventure is brought to an issue. This kind of contract being generally private, the parties concerned are not liable for each other. If one of them purchase goods on trust, the furnisher, who grants the credit through confidence in him alone, has no recourse, in case of his insolvency, against the other partners. They are only answerable for the share of the adventure that belongs to the insolvent partner.

If it be proposed to carry the adventure farther than originally agreed on, any partner may withdraw his interest; and if it cannot be separated from the others, may insist that the whole shall be brought to an issue.

II. Standing companies, which are generally established by written contract between the parties, where the stock, the firm, duration, the division of the gain or loss, and other circumstances, are inserted.

All the partners are generally authorized to sign by the firm of the company, though this privilege may be confined to some of them by particular agreement. The firm ought only to be subscribed at the place where the copartnery is established. If a partner has occasion, when absent, to write a letter relating to their affairs, he subscribes his own name on account of the company. When the same partners carry on business at different places, they generally choose different firms for each. The signature of each partner is generally sent to new correspondents; and when a partner is admitted, although there be no alteration in the firm, his signature is transmitted, with an intimation of the change in the copartnery to all their correspondents. Houses that have been long established, often retain the old firm, though all the original partners be dead or withdrawn.

The powers of each partner are, in general discretionary; but they ought not to act, in matters of importance, without consulting together, when there is an opportunity. No partner is liable to make good the loss arising from his judging wrong in a case where he had authority to act. If he exceeds his power, and the event prove unsuccessful, he must bear the loss; but if it prove successful, the gain belongs to the company: yet if he acquaints the company immediately of what he has done, they must either acquiesce therein, or leave him the chance of gain, as well as the risk of loss.

All debts contracted under the firm of the company are binding on the whole partners, though the money was borrowed by one of them for his private use, without the consent of the rest. And if a partner exceeds his power, the others are nevertheless obliged to implement his engagements; though they may render him responsible for his misbehaviour.

Although the sums to be advanced by the partners be limited by the contract, if there be a necessity for raising more money to answer emergencies or pay the debts of the company, the partners must furnish what is necessary, in proportion to their shares.

A debt to a company is not cancelled by the private debts of the partner: and when a partner becomes insolvent, the company is not bound for his debts beyond the extent of his share.

The debts of the company are preferable, on the company's effects, to the private debts of the partners.

Partnership is generally dissolved by the death of a partner; yet, when there are more parners than two, it may, by agreement, subsist among the survivors. Sometimes it is stipulated, that, in case of the death of a partner, his place shall be supplied by his son, or some other person condescended on. The contract ought to specify the time and manner in which the surviving partners shall reckon with the executors of the deceased for his share of the stock, and a reasonable time allowed for that purpose.

When partnership is dissolved, there are often outstanding debts that cannot be recovered for a long time, and effects that cannot easily be disposed of. The partnership, though dissolved in other respects, still subsists for the management of their oustanding affairs: and the money arising from them is divided among the partners, or their representatives, when it is recovered. But as this may protract the final settlement of the company's affairs to a very inconvenient length, other methods are sometimes used to bring them to a conclusion, either in consequence of the original contract, or by agreement at the time of dissolution. Sometimes the debts and effects are sold by auction; sometimes they are divided among the partners; and when there are two partners, one divides them into shares, as equal as possible, and the other chooses either share he thinks best.

If a partner withdraws, he continues responsible for his former partners till it be publicly known that he hath done so. A deed of separation, registered at a public office, is sufficient presumption of such notoriety.

III. Companies, where the business is conducted by officers. There are many companies of this kind in Britain, chiefly established for purposes which require a larger capital than private merchants can command. The laws with respect to these companies, when not confirmed by public authority, are the same as the former, but the articles of their agreement usually very different. The capital is condescended on; and divided into a certain number of shares, whereof each partner may hold one or more, but is generally restricted to a certain number. Any partner may transfer his share; and the company must admit his assignee as a partner. The death of the partners has no effect on the company. No partner can act personally in the affairs of the company: but the execution of their business is intrusted to officers, for whom they are responsible; and, when the partners are numerous, the superintendency of the officers is committed to directors chosen annually, or at other appointed times, by the partners.

IV. Companies incorporated by authority. A royal charter is necessary to enable a company to hold lands, to have a common seal, and enjoy the other privileges of a corporation A charter is sometimes procured, in order to limit the risk of the partners: for, in every private company, the partners are liable for the debts, without limitation; in corporated societies, they are only liable for their shares in the stock of the society. The incorporation of societies is sometimes authorized by act of parliament: but this high authority is not necessary, unless for conferring exclusive privileges.

Moral and Political Philosophy. Mr Paley says, "I know of nothing upon the subject of partnership that requires explanation, but how the profits are to be divided where one partner contributes money and the other labour, which is a common case.

"*Rule.* From the stock of the partnership deduct the sum advanced, and divide the remainder between the moneyed partner and the labouring partner, in the proportion of the interest of the money to the wages of the labour, allowing such a rate of interest as money might be borrowed for upon the same security, and such wages as a journeyman would require for the same labour and trust.

"*Example.* A advances 1000l. but knows nothing of the business; B produces no money, but has been brought up to the business, and undertakes to conduct it. At the end of the year the stock and effects of the partnership amount to 1200l. consequently there are 200l. to be divided. Now nobody would lend money, upon the event of the business succeeding, which is A's security, under 6 per cent. therefore A must be allowed 60l. for the interest of his money. B, before he engaged in the partnership, earned 30l. a-year in the same employment: his labour, therefore, ought to be valued at 30l. and the 200l. must be divided between the partners in the proportion of 60 to 30; that is, A must receive 133l. 6s. 8d. and B 66l. 13s. 4d. If there be nothing gained, A loses his interest, and B his labour, which is right. If the original stock be diminished, by this rule B loses only his labour as before; whereas A loses his interest and part of the principal; for which eventual disadvantage A is compensated, by having the interest of his money computed at 6 per cent. in the division of the profits when there is any. It is true, that the division of the profit is seldom forgotten in the constitution of the partnership; and is therefore commonly settled by express agreement; but these agreements, to be equitable, should pursue the principle of the rule here laid down. All the partners are bound by what any one of them does in the course of the business; for *quoad hoc*, each partner is considered as an authorized agent for the rest.

PARTRIDGE, a species of bird. See TETRAO, ORNITHOLOGY *Index*.

The partridge is so valuable at the table, that a great many ways of taking it have been invented by sportsmen, all of which succeed from the natural folly and timidity of the animal.

The places partridges delight in most are corn fields, especially whilst the corn grows, for under that cover they shelter and breed: neither are those places unfrequented by them when the corn is cut down, by reason of the grain they find there, especially in wheat stubble, the height of which they delight in, being to them as a covert or shelter. When the wheat stubble is much trodden by men or beasts, they then betake themselves to the barley stubble, provided it be fresh and untrodden; and they will, in the furrows, amongst the clots, branches, and long grass, hide both themselves and coveys, which are sometimes 20 in number, nay, 30 in a covey.

When the winter season is arrived, and the stubble fields are ploughed up, or over-soiled with cattle, partridges resort into the upland meadows, and lodge in the dead grass, or fog, under hedges, amongst mole hills, or under the roots of trees; sometimes they resort to coppices and underwoods, especially if any corn fields are adjacent, or where there is grown broom, brakes, fern, &c.

In the harvest time, when every field is full of men and cattle, in the day time they are found in the fallow fields which are next adjoining to the corn fields, where they lie lurking till evening or morning, and then they feed among the sheaves of corn.

When their haunts are known, according to the situation of the country and season of the year, the next care must be to find them out in their haunts, which is done several ways. Some do it by the eye only; and this art can never be taught, but learned by frequent experience, the colour of the birds being so like that of the earth at a distance, that no eye but a very conversant one could distinguish them. When they are once seen, the business is to keep the eye upon them, and then to keep in continual motion. They are a very lazy bird, and by this means will let a person almost tread upon them; though if the person stands still to eye them, they will rise immediately though they be at a considerable distance.

Another method of discovering them is, by going to their haunts very early in the morning, or at the close of the evening, which is called the *jucking* time. The noise of the cock partridge is to be attended to at this time, and is very loud and earnest. The hen will soon come up to the cock after her making the noise, which she does by way of answer; and when they are got together, their chattering will discover them. Thus they may always be found at these times. But there is yet a better method of finding this bird, which is by the *call*. The business, in order to have success in this way, is carefully to learn the notes of the partridge, and be able to imitate all the several sounds. When perfect in this, the person is to go to the haunts morning and evening, and placing himself in some place where he can see the birds without being seen by them, he is to listen to their calling; and when they are heard, he is to answer in the same notes, doubling again as they do: by continuing this, they may be brought so near, that the person lying down on his back may count their whole number. Having in this manner found where the birds are, the next care is to catch them.

They are so foolish, that it is extremely easy to take them in *nets*. In order to this, there needs no more that the going out, provided with two or three nets, with meshes somewhat smaller than those of the pheasant nets, and walking round about the covey, a net is to be fixed so as to draw over them, on pulling a line at a distance. All this may be easily done; for so long as the sportsman continues moving about, and does not fix his eye too intensely upon them, they will let him come near enough to fix the net without moving. If they lie so straggling, that one net will not cover them, then two or three must be fixed in the same manner. The sportsman may then draw the nets over them, and they will often lie still with the nets upon them till he comes up to fright them; then they will rise, and be entangled in the net.

A second method of taking them is with *bird lime*: this is done by means of wheat straws. These must be large, and cut off between knot and knot; they must be well limed with the best and strongest bird lime, and the sportsman must carry a great number out with him. Having found a field where there are partridges, he is to call; and if they answer, he is then to stick up the limed straws in rows across two or three lands, and going backward, call again to them, leading them on in the road where the straws are: they will follow one another like a flock of chickens, and come out to the call; and will in their way run upon the straws, and liming themselves they will daub one another by crowding together, so that very few of them will be able to escape.

But there is yet a pleasanter way of taking them than this, that is, by *driving* of them. In order to this, an engine is to be made of canvass stuffed with straw, to represent a horse; this horse and nets are to be taken to the haunts of the partridges, and the nets being placed slanting or slopwise in the lower part of the field, the sportsman is to take the wind in his back and get above them, driving them downwards; his face is to be covered with something green or blue, and placing the horse before him, he is to go towards them slowly and gently; and by this means they will be raised on their legs, but not on their wings, and will run before the horse into the nets. If in the way they go into a wrong path, the horse is to be moved to face them; and they will be thus driven back again, and driven every way the sportsman pleases.

The partridges of Abyssinia, we are told, are very large, being as big as *capons*.

In Jeremiah xvii. 11. we have the following curious passage: "As the partridge sitteth on *eggs*, and hatcheth *them* not; so he that getteth riches, and not by right, shall leave them in the midst of his days, and at his end shall be a fool;" which is explained by Mr Poole as follows: It is no wonder if we cannot be certain as to the sense of these words, so far as they concern natural history, when we are not certain what bird it is to which this doth relate. We translate it *partridge*: others will have it to be a *cuckoo*; but certain it is, that it is the same word which we translate *partridge*, (1 Sam. xxvi. 20.); and cuckoos use not to be much hunted after. How the partridge is said to sit on eggs and hatch them not, is yet a greater question. It may be occasioned so many ways, viz. either sitting upon wind eggs; or being killed before the eggs are hatched; or having its eggs destroyed by the male partridge, or by some dog or other vermine; or, its nest being found, having her eggs taken from her, that it is hard to determine which the prophet means. Of all others, I least approve of that which Jerome makes the sense, though the thing be true (if we may believe Cassiodorus and several natural historians, Aldrovandus, &c.), that partridges have such a love and desire to hatch young ones, that having lost their own eggs, they will steal the eggs of other partridges, and hatch them; which being hatched, the young ones knowing the cry of their proper dams, hearing them call, leave the partridge that hatched them (which is one thing quoted by Aldrovandus, to show the sagacity of that bird); but if this were the sense, the words would be, 'as the partridge sitteth on eggs, and hatcheth them, but enjoyeth them not;' whereas they are, 'hatcheth them not:' that is, having lost them, either by some man that hath taken them from her, or by some vermin or wild beast." *Poole's Annot. in Loc.*

The words in the original are, דגר ולא ילד קרא, which the Septuagint translate ἐφώνησε πέρδιξ, &c. "The partridge cried; it gathered together what it had not produced;" and some translate the Hebrew, "The partridge lays many eggs, but does not hatch them all." Le Clerc, upon the authority of Bocchart, understands the Hebrew word *kore* here to signify a *woodcock*. Le Clerc's translation is as follows: *Rusticula ova colligit, sed non parit; facit sibi divitias, sed sine jure, mediis suis diebus eas relinquit, atque ad extremum stulta est.*

PARTURITION, the act of bringing forth or being delivered of young. See MIDWIFERY.

PARTY, in a military sense, a small number of men, horse or foot, sent upon any kind of duty; as into an enemy's country to pillage, to take prisoners, and to oblige the country to come under contribution. Parties are often sent out to view the roads and ways, get intelligence, seek forage; to reconnoitre, or amuse the enemy upon a march: they are also frequently sent upon the flanks of any army or regiment, to discover the enemy if near, and prevent surprise or ambuscade.

PARVICH, an island near Dalmatia, and one of the best peopled and most considerable of those which are under the jurisdiction of Sibenico. It contains a great number of fishermen, and a considerable number of persons employed in agriculture. It contains many Roman antiquities, which evidently show that it was a Roman station. It seems to be among the number of those islands which Pliny calls *Celadussæ*, which is supposed to be an inversion of δυσκέλαδος; which means *ill sounding* or *noisy*. Parvich is not of large extent, but it is extremely fertile. Every product succeeds in perfection there: we mean those products of which a very shallow ground is susceptible; such as wine, oil, mulberry-trees, and fruit. The aspect of this island is also very pleasant at a distance, whereas that of the others adjacent disgusts the eye, by their too high, rocky, and bare hills. The name of *Parvich* seems to have been given it because it is the first one meets with on going out of the harbour of Sibenico; for the Illyric word *parvi* signifies *first*.

PARULIDES, in *Surgery*, tumors and inflammations of the gums, commonly called *gum-boils*. They are to be treated with discutients like other inflammatory tumors.

PARUS, or TITMOUSE, a genus of birds belonging to the order of passeres. See ORNITHOLOGY *Index*.

PASCAL, BLAISE, one of the greatest geniuses and best writers France has produced, was born at Clermont in Auvergne, in the year 1623. His father, Stephen Pascal, born in 1588, and of an ancient family, was president of the court of aids in his province: he was a very learned man, an able mathematician, and a friend of Descartes. Having an extraordinary tenderness for this child, his only son, he quitted his office in his province, and went and settled at Paris in 1631, that he might be quite at leisure for the instruction of him; and Blaise never had any master but his father. From his infancy he gave proofs of a very extraordinary capacity: for he desired to know the reason of every thing; and when good reasons were not given him, he would seek for better; nor would he ever yield his assent but upon such as appeared to him well grounded. There was room to fear, that with such a cast of mind he would fall into free thinking, or at least into heterodoxy; yet he was always very far from any thing of this nature.

What is told of his manner of learning the mathematics, as well as the progress he quickly made in that science, seems almost miraculous. His father, perceiving in him an extraordinary inclination to reasoning, was afraid lest the knowledge of the mathematics would hinder his learning the languages. He kept him therefore as much as he could from all notions of geometry, locked up all his books of that kind, and refrained even from speaking of it in his presence. He could not, however, make his son refrain from musing upon proportions; and one day surprised him at work with charcoal upon his chamber-floor, and in the midst of figures. He asked him what he was doing? I am searching, says Pascal, for such a thing; which was just the 32d proposition of the first book of Euclid. He asked him then how he came to think of this? It was, says Pascal, because I have found out such another thing: and so going backward, and using the names of *bar* and *round*, he came at length to the definitions and axioms he had formed to himself. Does it not seem miraculous that a boy should work his way into the heart of a mathematical book, without ever having seen that or any other book upon the subject, or knowing any thing of the terms? Yet we are assured of the truth of this by Madame Perrier, and several other writers, the credit of whose testimony cannot reasonably be questioned. He had, from henceforward, full liberty to indulge his genius in mathematical pursuits. He understood Euclid's Elements as soon as he cast his eyes upon them: and this was not strange; for, as we have seen, he understood them before. At 16 years of age he wrote a treatise of conic sections, which was accounted by the most learned a mighty effort of genius; and therefore it is no wonder that Descartes, who had been in Holland a long time, should, upon reading it, choose to believe that Mr Pascal the father was the real author of it. At 19, he contrived an admirable arithmetical machine, which was esteemed a very wonderful thing, and would have done credit as an invention to any man versed in science, and much more to such a youth.—About this time his health became impaired, and he was in consequence obliged to suspend his labours; nor was he in a condition to resume them till four years after. About that period, having seen Torricelli's experiment respecting a vacuum and the weight of the air, he turned his thoughts towards these objects; and in a conference with Mr Petit, intendant of fortifications, proposed to make farther researches. In consequence of this idea, he undertook several new experiments, one of which was as follows:—Having provided a glass tube, 46 feet in length, open at one end, and sealed hermetically at the other, he filled it with red wine, that he might distinguish the liquor from the tube. He then elevated it in this condition; and having placed it perpendicularly to the horizon, stopped up the bottom, and plunged it into a vessel full of water, to the depth of a foot; after which he opened the extremity of the tube, and the wine descended to the distance of about 32 feet from the surface of the vessel, leaving a considerable vacuum at the upper extremity. He next inclined the tube, and remarked that the wine rose higher: and having inclined it till the top was within 32 feet of the ground, making the wine thus run out, he found that the water rose in it, so that it was partly filled with that fluid, and partly with wine. He made also a great many experiments with siphons, syringes, bellows, and all kinds of tubes, making use of different liquors, such as quicksilver, water, wine, oil, &c.; and having published them in 1647, dispersed his work throughout all France, and transmitted it also to foreign countries. All these experiments, however, ascertained effects, without demonstrating the causes. Pascal knew that Torricelli conjectured that those phenomena which he had observed were occasioned by the weight of the air (A); and, in order to discover the truth of this theory, he made an experiment at the top and bottom of a mountain in Auvergne, called *Le Puy de Dome*, the result of which gave him reason to conclude that air was weighty. Of this experiment he published an account, and sent copies of it to most of the learned men in Europe. He likewise renewed it at the top of several high towers, such as those of Notre Dame at Paris, St Jacques de la Boucherie, &c.; and always remarked the same difference in the weight of the air, at different elevations. This fully convinced him of the weight of the atmosphere; and from this discovery he drew many useful and important inferences. He composed also a large treatise, in which he thoroughly explained this subject, and replied to all the objections that had been started against it. As he thought this work rather too prolix, and as he was fond of brevity and precision, he divided it into two small treatises, one of which he entitled, A Dissertation on the Equilibrium of Liquors; and the other, An Essay on the Weight of the atmosphere. These labours procured Pascal so much reputation, that the greatest mathematicians and philosophers of the age proposed various questions to him, and consulted him respecting such difficulties as they could not solve.—Some years after, while tormented with a violent fit of the toothache, he discovered the solution of a problem proposed by Father Mersenne, which had baffled the penetration of all those who had attempted it. This problem was to determine the curve described in the air by the nail of a coach-wheel, while the machine is in motion. Pascal offered a reward of 40 pistoles to any one who should give a satisfactory answer to it. No one, however, having succeeded, he published his own at Paris; but as he began now to be disgusted with the sciences, he would not put his real name to it, but sent it abroad under that of A. d'Ettenville.—This was the last work which he published in the mathematics; his infirmities now increasing so much, that he was under the necessity of renouncing severe study, and of living so recluse, that he scarcely admitted any person to see him.

After he had thus laboured abundantly in mathematical and philosophical disquisitions, he forsook those studies and all human learning at once; and determined to know nothing, as it were, for the future, but Jesus Christ and him crucified. He was not 24 years of age, when the reading some pious books had put him upon taking this holy resolution; and he became as great a devotee as any age has produced. Mr Pascal now gave himself up entirely to a state of prayer and mortification. He had always in his thoughts these great maxims, of renouncing all pleasure and all superfluity; and this he practised with rigour even in his illnesses, to which he was frequently subject, being of a very invalid habit of body: for instance, when his sickness obliged him to feed somewhat delicately, he took great care not to relish or taste what he ate. He had no violent affection for those he loved; he thought it sinful, since a man possesses a heart which belongs only to God. He found fault with some discourses of his sister, which she thought very innocent; as if she had said upon occasion, that she had seen a beautiful woman, he would be angry, and tell her, that she might raise bad thoughts in footmen and young people. He frequently wore an iron girdle full of points next to his skin; and when any vain thought came into his head, or when he took particular pleasure in any thing, he gave himself some blows with his elbow, to redouble the prickings, and to recal himself to his duty.

Though Mr Pascal had thus abstracted himself from the world, yet he could not forbear paying some attention to what was doing in it; and he even interested himself in the contest between the Jesuits and the Jansenists. The Jesuits, though they had the popes and kings on their side, were yet decried by the people, who brought up afresh against them the assassination of Henry the Great, and all the old stories that were likely to make them odious. Pascal went farther; and by his *Lettres Provinciales* (B), published in 1656, under the name of *Louis de Montalte*, made them the

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(A) Before this period, all those effects which are now known to be produced by the weight of the atmosphere were attributed to Nature's abhorrence of a vacuum.

(B) The origin of these letters was this: for the sake of unbending his mind, Pascal used often to go to Port Royal des Champs, where one of his sisters had taken the veil, and where he had an opportunity of seeing the celebrated Mr Arnaud, and several of his friends. This gentleman's dispute with the doctors of the Sorbonne, who were endeavouring to condemn his opinions, was of course frequently brought upon the carpet. Mr Arnaud, solicited to write a defence, had composed a treatise, which, however, did not meet with approbation, and which he himself considered as a very indifferent work. Pascal being one day in company, some of those present, who were sensible of his abilities, having said to him, "You who are a young man ought to do something;" he took the hint, and composed a letter, which he showed to his friends, and which was so much admired, that they insisted on its being printed. The object of this letter is an explanation of the terms, *next power*, *sufficient grace*, and *actual grace;* and the author here shows, as well as in two others which followed it, that a regard for the faith was not the motive which induced the doctors of the Sorbonne to enter into dispute with Mr Arnaud, but a desire of oppressing him by ridiculous questions. Pascal, therefore, in other letters which he published afterwards, attacks the Jesuits, whom he believed to be the authors of this quarrel, and in the most elegant style, seasoned with wit and satire, endeavours to render them not only odious but ridiculous. For this the subject of ridicule. "These letters (says Voltaire) may be considered as a model of eloquence and humour. The best comedies of Moliere have not more wit than the first part of these letters; and the sublimity of the latter part of them is equal to any thing in Bossuet. It is true, indeed, that the whole book was built upon a false foundation; for the extravagant notions of a few Spanish and Flemish Jesuits were artfully ascribed to the whole society. Many absurdities might likewise have been discovered among the Dominican and Franciscan casuists; but this would not have answered the purpose; for the whole raillery was to be levelled only at the Jesuits. These letters were intended to prove, that the Jesuits had formed a design to corrupt mankind; a design which no sect or society ever had, or can have." Voltaire calls Pascal the first of their satirists; for Despreaux, says he, must be considered as only the second. In another place, speaking of this work of Pascal, he says, that "examples of all the various species of eloquence are to be found in it. Though it has been now written almost 100 years, yet not a single word occurs in it, savouring of that vicissitude to which living languages are so subject. Here then we are to fix the epocha when our language may be said to have assumed a settled form. The bishop of Lucon, son of the celebrated Bussy, told me, that asking one day the bishop of Meaux what work he would covet most to be the author of, supposing his own performances set aside, Bossuet replied, The Provincial Letters." These letters have been translated into all languages, and printed over and over again. Some have said, that there were decrees of formal condemnation against them; and also that Pascal himself, in his last illness, detested them, and repented of having been a Jansenist: but both these particulars are false and without foundation. Father Daniel was supposed to be the anonymous author of a piece against them, entitled, The Dialogues of Cleander and Eudoxus.

Pascal was only about the age of 30 when these letters were published, yet he was extremely infirm, and his disorders increasing soon after, so much that he conceived his end fast approaching, he gave up all farther thoughts of literary composition. He resolved to spend the remainder of his days in retirement and pious meditation; and with this view he broke off all his former connection, changed his habitation, and spoke to no one, not even to his own domestics. He made his own bed, fetched his dinner from the kitchen, carried it to his apartment, and brought back the plates and dishes in the evening; so that he employed his servants only to cook for him, to go to town, and to do such other things as he could not absolutely do himself. In his chamber nothing was to be seen but two or three chairs, a table, a bed, and a few books. It had no kind of ornament whatever; he had neither a carpet on the floor nor curtains to his bed; but this did not prevent him from sometimes receiving visits; and when his friends appeared surprised to see him thus without furniture, he replied, that he had what was necessary, and that any thing else would be a superfluity, unworthy of a wise man. He employed his time in prayer, and in reading the Holy Scriptures; and he wrote down such thoughts as this exercise inspired. Though his continual infirmities obliged him to use very delicate food, and though his servants employed the utmost care to provide only what was excellent, he never relished what he ate, and seemed quite indifferent whether what they brought him was good or bad. When any thing new and in season was presented to him, and when he was asked, after he had finished his repast, how he liked it, he replied, "You ought to have informed me before-hand, I should have then taken notice of it." His indifference in this respect was so great, that though his taste was not vitiated, he forbade any sauce or ragout to be made for him which might excite his appetite. He took without the least repugnance all the medicines that were prescribed him for the re-establishment of his health; and when Madame Perrier, his sister, seemed astonished at it, he replied ironically, that he could not comprehend how people could ever shew a dislike to a medicine, after being apprised that it was a disagreeable one, when they took it voluntarily; for violence or surprise ought only to produce that effect.

Though Pascal had now given up intense study, and though he lived in the most temperate manner, his health continued to decline rapidly; and his disorders had so enfeebled his organs, that his reason became in some measure affected. He always imagined that he saw a deep abyss on his left side, and he never would sit down till a chair was placed there, to secure him from the danger

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this purpose he employs the form of dialogue, and introduces an ignorant person, as men of the world generally are, who requests information respecting the questions in dispute from these doctors, whom he consults by proposing his doubts; and his answers to their replies are so perspicuous, pertinent, and just, that the subject is illustrated in the clearest manner possible. He afterwards exposes the morality of the Jesuits, in some conversations between him and one of their casuists, in which he still represents a man of the world, who seeks for instruction, and who, hearing maxims altogether new to him, seems astonished, but still listens with moderation. The casuist believes that he is sincere, and relishes these maxims; and under this persuasion he discovers every thing to him with the greatest readiness. The other is still surprised; and as this instructor attributes this surprise only to the novelty of his maxims, he still continues to explain himself with the same confidence and freedom. This instructor is a simple kind of man, who is not overburdened with acuteness, and who insensibly engages himself in details which always become more particular. The person who listens, wishing neither to contradict him nor to subscribe to his doctrine, receives it with an ambiguous kind of raillery; which, however, sufficiently shows what opinion he entertains of it. The Jesuits reproached the author with having employed only raillery against them, and with having misrepresented several passages of their authors; which induced Pascal to write eight more in vindication of himself. All these letters, in number 18, written in a style altogether new in France, appeared in 4to, one after another, from the month of January 1656, to the month of March of the year following.

danger which he apprehended. His friends did every thing in their power to banish this melancholy idea from his thoughts, and to cure him of his error, but without the desired effect; for though he would become calm and composed for a little, the phantom would in a few moments again make its appearance and torment him. The cause of his seeing this singular vision for the first time, is said to have been as follows: His physicians, alarmed on account of the exhausted state to which he was reduced, had advised him to substitute easy and agreeable exercise for the fatiguing labours of the closet. One day, in the month of October 1654, having gone according to custom to take an airing on the Pont de Neuilly, in a coach and four, the two first horses suddenly took fright, opposite to a place where there was no parapet, and threw themselves violently into the Seine; but the traces luckily giving way, the carriage remained on the brink of the precipice. The shock which Pascal, in his languishing situation, must have received from this dreadful accident, may easily be imagined. It threw him into a fit, which continued for some time, and it was with great difficulty that he could be restored to his senses. After this period his brain became so deranged, that he was continually haunted by the remembrance of his danger, especially when his disorders prevented him from enjoying sleep. To the same cause was attributed a kind of vision or ecstacy that he had some time after: a memorandum of which he preserved during the remainder of his life in a bit of paper, put between the cloth and the lining of his coat, and which he always carried about him. Some of the Jesuits had the baseness and inhumanity to reproach this great genius with the derangement of his organs. In the Dictionary of Jansenist Books, he is called a *hypochondriac*, and a man of a *wrong head* and a *bad heart*. But, as a celebrated writer has observed, Pascal's disorder had in it nothing more surprising or disgraceful than a fever or the vertigo. During the last years of his life, in which he exhibited a melancholy example of the humiliating reverses which take place in this transitory scene, and which, if properly considered, might teach mankind not to be too proud of those abilities which a moment may take from them, he attended all the salutations (c), visited every church in which relicks were exposed, and had always a spiritual almanack, which gave an account of all those places where particular acts of devotion were performed. On this occasion it has been said, that "Religion renders great minds capable of little things, and little minds capable of great."

In company, Pascal was distinguished by the amiableness of his behaviour; by his easy, agreeable, and instructive conversation, and by great modesty. He possessed a natural kind of eloquence, which was in a manner irresistible. The arguments he employed for the most part produced the effect which he proposed; and though his abilities entitled him to assume an air of superiority, he never displayed that haughty and imperious tone which may often be observed in men of shining talents. The philosophy of this great man consisted in renouncing all pleasure, and every superfluity. He not only denied himself the most common gratification but he took also without reluctance, and even with pleasure, either as nourishment or as remedies, whatever was disagreeable to the senses; and he every day retrenched some part of his dress, food, or other things, which he considered as not absolutely necessary. Towards the close of his life, he employed himself wholly in pious and moral reflections, writing down those which he judged worthy of being preserved. The first piece of paper he could find was employed for this purpose; and he commonly put down only a few words of each sentence, as he wrote them merely for his own use. The bits of paper upon which he had written these thoughts, were found after his death filed upon different pieces of string, without any order or connection; and being copied exactly as they were written, they were afterwards arranged and published.

The celebrated Bayle, speaking of this great man, says, A hundred volumes of sermons are not of so much avail as a simple account of the life of Pascal. His humility and his devotion mortified the libertines more than if they had been attacked by a dozen of missionaries. In a word, Bayle had so high an idea of this philosopher, that he calls him *a paradox in the human species*. "When we consider his character (says he), we are almost inclined to doubt that he was born of a woman, like the man mentioned by Lucretius:

> "*Ut vix humana videatur stirpe creatus.*"

Mr Pascal died at Paris the 19th of August 1662, aged 39 years. He had been some time about a work against atheists and infidels, but did not live long enough to digest the materials he had collected. What was found among his papers was published under the title of *Pensées*, &c. or *Thoughts upon religion and other subjects*, and has been much admired. After his death appeared also two other little tracts; one of which is intitled, *The equilibrium of fluids*; and the other, *The weight of the mass of air*.

The works of Pascal were collected in five volumes 8vo, and published at the Hague by De Tune, and at Paris by Nyon senior, in 1779. This edition of Pascal's works may be considered as the first published; at least the greater part of them were not before collected into one body; and some of them had remained only in manuscript. For this collection, the public were indebted to the abbé Bossu, and Pascal deserved to have such an editor. "This extraordinary man (says he) inherited from nature all the powers of genius. He was a geometrician of the first rank, a profound reasoner, and a sublime and elegant writer. If we reflect, that in a very short life, oppressed by continual infirmities, he invented a curious arithmetical machine, the elements of the calculation of chances, and a method of resolving various problems respecting the cycloid; that he fixed in an irrevocable manner the wavering opinions of the learned respecting the weight of the air; that he wrote one of the completest works which exist in the French language; and that in his Thoughts there are passages,

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(c) Certain solemn prayers, which are repeated at certain hours, and on certain days, in the Popish churches.

the depth and beauty of which are incomparable—we shall be induced to believe, that a greater genius never existed in any age or nation. All those who had occasion to frequent his company acknowledged his superiority. His conversation instructed, without making those who heard him sensible of their own inferiority; and he was remarkably indulgent towards the faults of others. It may be easily seen by his Provincial Letters, and by some of his other works, that he was he born with a great fund of humour, which his infirmities could never entirely destroy. In company, he readily indulged in that harmless and delicate raillery which never gives offence, and which greatly tends to enliven conversation; but its principal object generally was of a moral nature. For example, ridiculing those authors who say, *My Book*, *my Commentary*, *my History*, they would do better (added he) to say, *Our Book*, *our Commentary*, *our History;* since there are in them much more of other people's than their own." An elegant Latin epitaph was inscribed on his tomb. See remarks on his philosophical character, in the First Dissertation, vol. 1st. SUPPLEMENT, p. 125.

PASCHAL, something belonging to the passover, or Easter. See PASSOVER and EASTER.

PAS-EP-A, the chief of the Lamas, particularly eminent for having invented characters for the Moguls. He was much esteemed by the Chinese, though the literati exclaimed against the manner in which the people demonstrated their affection. There is still at Pekin a *myau* or temple, built in honour of Pas-ep-a in the time of the Mogul emperors. He died in 1279.

PASIGRAPHY (from πας, *omnis*, and γραφω, *scribo*), the art of writing on any subject whatever, so as to be universally understood by all nations upon earth. The idea of establishing such a language is deemed by many extremely fanciful and absurd, while the practicability of it is as strenuously contended for by others. Hints respecting such a system of writing as might be understood by all mankind, are to be met with in the writings of many eminent philosophers; but if such an attempt failed in the hands of a Leibnitz, a Kircher, a Becher, a Wilkins, and some others, it is at least to be presumed, that the execution of a pasigraphy, or universal language, will always be found to bear a striking analogy to the chimerical sentiments which were formerly entertained respecting the doctrines of the quadrature of the circle, the multiplication of the cube, the philosopher's stone, or perpetual motion, all of which have been finely ridiculed by Dean Swift in his idea of circular shot. Kant is clearly of opinion, however, that such a pasigraphy falls within the limits of possibility;—nay, he even asserts, that it will actually be established at some future period. And, while none of its admirers venture to bid us believe that it will ever be universally spoken, or understood, they confidently think, that, by means of it, the valuable labours of erudition and human genius will be effectually prevented from ever falling into oblivion. See a Memoir on this subject in Nicholson's Journal, ii. 342. 4to.

PASIPHAE, in fabulous history, daughter of the Sun by Perseis, who married Minos king of Crete. She disgraced herself by an unnatural passion for a bull, which we are told she was enabled to gratify by means of the artist Dædalus. This celebrated bull had been given to Minos by Neptune, to be offered on his altars. But as the monarch refused to sacrifice the animal on account of his beauty, the god revenged his disobedience by inspiring Pasiphaë with an unnatural love for him. This fable, which is universally believed by the poets, who observe, that the minotaur was the fruit of this infamous commerce, is refuted by some writers; who suppose that the infidelity of Pasiphaë to her husband was betrayed in her affection for an officer of the name of Taurus, and that Dædalus, by permitting his house to be the asylum of the two lovers, was looked upon as accessory to the gratification of Pasiphaë's lust. From this amour with Taurus, as it is farther remarked, the queen became mother of twins; and the name of *Minotaurus* arises from the resemblance of the children to the husband and the lover of Pasiphaë. Minos had four sons by Pasiphaë, Castreus, Deucalion, Glaucus, and Androgeus; and three daughters, Hecate, Ariadne, and Phædra.

PASQUIN, a mutilated statue at Rome, in a corner of the palace of the Ursini. It takes its name from a cobler of that city called *Pasquin*, famous for his sneers and gibes, and who diverted himself by passing his jokes on all that went through that street. After his death, as they were digging up the pavement before his door, they found in the earth the statue of an ancient gladiator, well cut, but maimed and half-spoiled: this they set up in the place, where it was found, and by common consent named it *Pasquin*. Since that time all satires are attributed to that figure; and are either put into its mouth, or pasted upon it, as if they were written by Pasquin redivivus; and these are addressed by Pasquin to Marforio, another statue at Rome. When Marforio is attacked, Pasquin comes to his assistance; and, when Pasquin is attacked, Marforio assists him in his turn; that is, the people make the statues speak just what they please.

PASQUINADE, a satirical libel fastened to the statue of Pasquin: these are commonly short, witty, and pointed; and from hence the term has been applied to all lampoons of the same cast.

PASS, or PASSADE, in fencing, an advance or leap forward upon the enemy. Of these there are several kinds; as passes within, above, beneath, to the right, the left, and passes under the line, &c. The measure of the pass is when the swords are so near as that they may touch one another.

PASS, in a military sense, a strait and difficult passage, which shuts up the entrance into a country.

Pass Parole, in military affairs, a command given at the head of an army, and thence communicated to the rear, by passing it from mouth to mouth.

PASSADE, in the manege, is a turn or course of a horse backwards or forwards on the same spot of ground. Hence there are several sorts of passades, according to the different ways of turning, in order to part or return upon the same tread, which is called *closing the passade;* as the passade of one time, the passade of five times, and the raised or high passades, into which the demivolts are made into curvets. See HORSEMANSHIP.

North-west PASSAGE. } See *North-West Passage*,
North-east PASSAGE. } *North-East Passage*, and POLE.

Right of PASSAGE, in commerce, is an imposition or duty exacted by some princes, either by land or sea, in certain close and narrow places in their territories, on all veſsels and carriages, and even sometimes on persons or passengers, coming in or going out of ports, &c. The most celebrated passage of this kind in Europe is the Sound: the dues for passing which strait belong to the king of Denmark, and are paid at Elsinore or Cronenburg.

PASSANT, in *Heraldry*, a term applied to a lion or other animal in a shield, appearing to walk leisurely: for most beasts, except lions, the *trippant* is frequently used instead of *passant*.

PASSAU, an ancient, handsome, and celebrated town of Germany, in Lower Bavaria, with a bishop's see and fort. The houses are well built, and the cathedral is thought to be the finest in all Germany. It is divided into four parts, three of which are fortified; but the other is only a suburb, and has nothing but an old castle in which the bishop generally resides. It is seated at the confluence of the rivers Inn and Iltz with the Danube, in E. Long. 13. 34. N. Lat. 48. 26.

PASSAU, a bishopric of Germany, lying between Lower Bavaria, Austria, and Bohemia. It extends not above 20 miles where largest; and has no considerable place, except the capital, which is of the same name.

PASSERES, the name of one of the orders (the 6th) into which the class of birds is divided. See ORNITHOLOGY *Index*.

PASSIFLORA, or PASSION FLOWER; a genus of plants belonging to the gynandria class; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. See BOTANY *Index*.

PASSION, is a word of which, as Dr Reid observes, the meaning is not precisely ascertained either in common discourse or in the writings of philosophers. In its original import, it denotes every *feeling* of the mind occasioned by an extrinsic cause; but it is generally used to signify some *agitation* of mind, opposed to that state of tranquillity in which a man is most master of himself. That it was thus used by the Greeks and Romans, is evident from Cicero's rendering *πάθος*, the word by which the philosophers of Greece expressed it, by *perturbatio* in Latin. In this sense of the word, passion cannot be itself a *distinct* and *independent* principle of action; but only an occasional degree of vehemence given to those dispositions, desires, and affections, which are at all times present to the mind of man; and that this is its proper sense, we need no other proof than that passion has always been conceived to bear analogy to a storm at sea or to a tempest in the air.

With respect to the number of passions of which the mind is susceptible, different opinions have been held by different authors. Le Brun, a French writer on painting, justly considering the expression of the passions as a very important as well as difficult branch of his art, has enumerated no fewer than twenty, of which the signs may be expressed by the pencil on canvass. That there are so many different states of mind producing different effects which are visible on the features and the gestures, and that those features and gestures ought to be diligently studied by the artist, are truths which cannot be denied; but it is absurd to consider all these different states of mind as *passions*, since tranquillity is one of them, which is the reverse of passion.

The common division of the passions into *desire* and *aversion*, *hope* and *fear*, *joy* and *grief*, *love* and *hatred*, has been mentioned by every author who has treated of them, and needs no explication; but it is a question of some importance in the philosophy of the human mind, whether these different passions be each a degree of an original and innate disposition, distinct from the dispositions which are respectively the foundations of the other passions, or only different modifications of one or two general dispositions common to the whole race.

The former opinion is held by all who build their system of metaphysics upon a number of distinct internal senses; and the latter is the opinion of those who, with Locke and Hartley, resolve what is commonly called instinct into an early association of ideas. (See INSTINCT). That without deliberation mankind instantly feel the passion of fear upon the apprehension of danger, and the passion of anger or resentment upon the reception of an injury, are truths which cannot be denied: and hence it is inferred, that the seeds of these passions are innate in the mind, and that they are not generated, but only swell to magnitude on the prospect of their respective objects. In support of this argument, it has been observed that children, without any knowledge of their danger, are instinctively afraid on being placed on the brink of a precipice; and that this passion contributes to their safety long before they acquire, in any degree equal to their necessities, the exercise of their rational powers. Deliberate anger, caused by a voluntary injury, is acknowledged to be in part founded on reason and reflection; but where anger impels one suddenly to return a blow, even without thinking of doing mischief, the passion is instinctive. In proof of this, it is observed, that instinctive anger is frequently raised by bodily pain, occasioned even by a stock or a stone, which instantly becomes an object of resentment, that we are violently incited to crush to atoms. Such conduct is certainly not rational, and therefore it is supposed to be necessarily instinctive.

With respect to other passions, such as the lust of power, of fame, or of knowledge, innumerable instances, says Dr Reid, occur in life, of men who sacrifice to them their ease, their pleasure, and their health. But it is absurd to suppose that men should sacrifice the end to what they desire only as means of promoting that end; and therefore he seems to think that these passions must be innate. To add strength to this reasoning he observes, that we may perceive some degree of these principles even in brute animals of the most sagacious kind, who are not thought to desire means for the sake of ends which they have in view.

But it is in accounting for the passions which are disinterested that the advocates for innate principles seem most completely to triumph. As it is impossible not to feel the passion of pity upon the prospect of a fellow creature in distress, they argue, that the basis of that passion must be innate; because pity, being at all times more or less painful to the person by whom it is felt, and frequently of no use to the person who is its object, it cannot in such instances be the result of deliberation, but merely the exertion of an original instinct. The same kind of reasoning is employed to prove that gratitude is the exercise of an innate principle. That good offices are, by the very constitution of our nature, apt to produce good will towards the benefactor, in good and bad men, in the savage and in the civilized, cannot surely be denied by any one in the least acquainted with human nature. We are grateful not only to the benefactors of ourselves as individuals, but also to the benefactors of our country; and *that*, too, when we are conscious that from our gratitude neither they nor we can reap any advantage. Nay, we are impelled to be grateful even when we have reason to believe that the objects of our gratitude know not our existence. This passion cannot be the effect of reasoning, or of association founded on reasoning; for, in such cases as those mentioned, there are no principles from which reason can infer the propriety or usefulness of the feeling. That *public spirit*, or the affection which we bear to our country, or to any subordinate community of which we are members, is founded on instinct is deemed so certain, that the man destitute of this affection, if there be any such, has been pronounced as great a monster as he who has two heads.

All the disinterested passions are founded on what philosophers have termed *benevolent affection*. Instead therefore of inquiring into the origin of each passion separately, which would swell this article to no purpose, let us listen to one of the finest writers as well as ablest reasoners of the age, treating of the origin of benevolent affection. "We may lay it down as a principle (says Dr Reid*), that all benevolent affections are in their nature agreeable; that it is essential to them to desire the good and happiness of their objects; and that their objects must therefore be beings capable of happiness. A thing may be desired either on its own account, or as the means in order to something else. That only can properly be called an object of desire which is desired upon its own account; and therefore I consider as benevolent those affections only which desire the good of their object ultimately, and not as means in order to something else. To say that we desire the good of others, only to procure some pleasure or good to ourselves, is to say that there is no benevolent affection in human nature. This indeed has been the opinion of some philosophers both in ancient and in later times. But it appears as unreasonable to resolve all benevolent affections into self-love, as it would be to resolve hunger and thirst into self-love. These appetites are necessary for the preservation of the individual. Benevolent affections are no less necessary for the preservation of society among men; without which men would become an easy prey to the beasts of the field. The benevolent affections planted in human nature, appear therefore no less necessary for the preservation of the human species than the appetites of hunger and thirst." In a word, pity, gratitude, friendship, love, and patriotism, are founded on different benevolent affections; which our learned author holds to be original parts of the human constitution."

This reasoning has certainly great force; and if authority could have any weight in settling a question of this nature, we know not that name to which greater deference is due than the name of him from whom it is taken. Yet it must be confessed that the philosophers, who consider the affections and passions as early and deep rooted associations, support their opinion with very plausible arguments. On their principles we have endeavoured elsewhere to account for the passions of fear and love, (see INSTINCT and LOVE); and we may here safely deny the truth of what has been stated respecting fear, which seems to militate against that account. We have attended with much solicitude to the actions of children; and have no reason to think that they feel terror on the brink of a precipice till they have been repeatedly warned of their danger in such situations by their parents or their keepers. Every person knows not only that they have no original or instinctive dread of fire, which is as dangerous to them as any precipice; but that it is extremely difficult to keep them from that destructive element till they are either capable of weighing the force of arguments, or have repeatedly experienced the pain of being burnt by it. With respect to sudden resentment, we cannot help considering the argument, which is brought in proof of its being instinctive, as proving the contrary in a very forcible manner. Instinct is some mysterious influence of God upon the mind exciting to actions of beneficial tendency: but can any benefit arise from wreaking our impotent vengeance on a stock or a stone? or is it supposable that a Being of infinite wisdom would excite us to actions so extravagantly foolish? We learn from experience to defend ourselves against rational or sensible enemies by retaliating the injuries which they inflict upon us; and if we have been often injured in any particular manner, the idea of that injury becomes in time so closely associated with the means by which it has been constantly repelled, that we never receive such an injury—a blow for instance—without being prompted to make the usual retaliation, without reflecting whether the object be sensible or insensible. So far from being instinctive does resentment appear to us, that we think an attentive observer may easily perceive how the seeds of it are gradually infused into the youthful mind; when the child, from being at first a timid creature shrinking from every pain, learns by degrees to return blow for blow and threat for threat.

But instead of urging what appears to ourselves of most weight against the instinctive system, we shall lay before our readers a few extracts from a dissertation on the origin of the passions, by a writer whose elegance of language and ingenuity of investigation do honour to the school of Hartley.

"When an infant is born (says Dr Sayers †), there is every reason to suppose that he is born without ideas. These are rapidly communicated through the medium of the senses. The same senses are also the means of conveying to him pleasure and pain. These are the hinges on which the passions turn: and till the child is acquainted with these sensations, it would appear that no passion could be formed in his mind; for till he has felt pleasure and pain, how can he desire any object, or wish for its removal? How can he either love or hate? Let us observe then the manner in which love and hatred are formed; for on these passions depend all the rest. When a child endures pain, and is able to detect the cause of it, the idea of pain is connected in his mind with that of the thing which produced it; and if the object which occasioned pain be again presented to the child, the idea of pain associated with it arises also. This idea consequently urges the child to avoid or to remove the object; and thus arises the passion of dislike or hatred. In the same manner, the passion of liking or love is readily formed in the mind of a child from the association of pleasant ideas with certain objects which produced them.

"The passions of hope and fear are states of the mind depending upon the good or bad prospects of gratifying love or hatred; and joy or sorrow arises from the final success or disappointment which attends the exertions produced by love or by hatred. Out of these passions, which have all a perceptible relation to our own good, and are universally acknowledged to be selfish, all our other passions are formed."

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* Essays on the Active Powers of Man.

† Disquisitions Metaphysical and Literary.

To account for the passions called *disinterested*, he observes, that in the history of the human mind we find many instances of our dropping an intermediate idea, which has been the means of our connecting two other ideas together; and that the association of these two remains after the link which originally united them has vanished. Of this fact the reader will find sufficient evidence in different articles of this work (see INSTINCT, N° 19. and METAPHYSICS, N° 101.): and, to apply it to the disinterested passions, let us suppose, with Dr Sayers, that any individual has done to us many offices of kindness, and has consequently much contributed to our happiness; it is natural for us to seek with some anxiety for the continuance of those pleasures which he is able to communicate. But we soon discern, that the surest way of obtaining the continuance of his friendly offices is to make them, as much as possible, a source of pleasure to himself. We therefore do every thing in our power to promote his happiness in return for the good he has conferred upon us, that thus we may attach him to us as much as we are able. Hitherto all is plainly selfish. We have been evidently endeavouring, for the sake of our own future gratification, to promote the happiness of this person: but observe the consequence. We have thus, by contemplating the advantage, to be derived to ourselves from promoting the prosperity of our friend, learned to associate a set of pleasant ideas with his happiness; but the link which has united them gradually escapes us, while the union itself remains. Continuing to associate pleasure with the well-being of our friend, we endeavour to promote it for the sake of his *immediate* gratification, without looking farther; and in this way his happiness, which was first attended to only as a means of future enjoyment, finally becomes an end. Thus then the passion which was originally selfish, is at length *disinterested*; its gratification being completed merely by its success in promoting the happiness of another.

In this way does our author account for the origin of gratitude; which at last becomes a habit, and flows spontaneously towards every man who has either been or intended to be our benefactor. According to him, it is easy to observe also, that from associating pleasure with the happiness of an individual when we procure it ourselves, it must of course soon follow, that we should experience pleasure from a view of his happiness any way produced; such happiness raising at all times pleasant ideas when it is presented to our minds. This is another feature of a disinterested affection, to feel delight from the mere increase of happiness in the object whom we love.

"It may be objected, perhaps, that parents seem to have an *instinctive* disinterested love of their offspring: but surely the love of a parent (A) for a new-born infant is not usually equal to that for a child of four or five years old. When a child is first born, the prospect and hopes of future pleasure from it are sufficient to make a parent anxious for its preservation. As the child grows up, the hope of future enjoyment from it must increase: hence would pleasure be associated with the well-being of the child, the love of which would of course become in due time disinterested."

Our author does not analyze *pity*, and trace it to its source in selfishness; but he might easily have done it, and it has been ably done by his master. Pity or compassion is the uneasiness which a man feels at the misery of another. It is generated in every mind during the years of childhood; and there are many circumstances in the constitution of children, and in the mode of their education, which make them particularly susceptible of this passion. The very appearance of any kind of misery which they have experienced, or of any signs of distress which they understand, excite in their minds painful feelings, from the remembrance of what they have suffered, and the apprehension of their suffering it again. We have seen a child a year old highly entertained with the noise and struggles made by its elder brother when plunged naked in a vessel filled with cold water. This continued to be the case for many days, till it was thought proper to plunge the younger as well as the elder; after which the daily entertainment was soon at an end. The little creature had not been itself plunged above twice till it ceased to find diversion by its brother's sufferings.—On the third day it cried with all the symptoms of the bitterest anguish upon seeing its brother plunge, though no preparation was then made for plunging itself; but surely this was not disinterested sympathy, but a feeling wholly selfish, excited by the remembrance of what it had suffered itself, and was apprehensive of suffering again. In a short time, however, the painful feelings accompanying the sight of its brother's struggles, and the sound of his cries, were doubtless so associated with that sight and that sound, that the appearance of the latter would have brought the former

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(A) That this is true of the father is certain; but it may be questioned whether it be equally true of the mother. A woman is no sooner delivered of her infant, than she caresses it with the utmost possible fondness. We believe, that if she were under the necessity of making a choice between her child of four years, and her infant an hour old, she would rather be deprived of the latter than of the former; but we are not convinced that this would proceed from a less degree of affection to the infant than to the child. She knows that the child has before his fourth year escaped many dangers which the infant must encounter, and may not escape; and it is therefore probable that her choice would be the result of prudent reflection. Though we are not admirers of that philosophy which supposes the human mind a bundle of instincts, we can as little approve of the opposite scheme which allows it no instincts at all. The storge of a mother to her new-born infant is undoubtedly instinctive, as the only thing which at that moment can be associated with it in her mind is the pain she has suffered in bringing it to the world.

former along with them, even though the child might have been no longer under apprehension of a plunging itself. This association, too, would soon be transferred to every boy in the same circumstances, and to similar sounds and struggles, from whatever cause they might proceed.

† Observations on Man.

Thus, as Dr Hartley observes †, "when several children are educated together, the pains, the denials of pleasure, and the sorrows which affect one generally extend to all in some degree, often in an equal one. When their parents, companions, or attendants are sick, or afflicted, it is usual to raise in their minds the nascent ideas of pains and miseries by such words and signs as are suited to their capacities. They also find themselves laid under many restraints, on account of the sickness or affliction of others; and when these and such like circumstances have raised in their minds desires to remove the causes of their own internal feelings, i. e. to cause the miseries of others, a variety of internal feelings and desires become so blended and associated together, as that no part can be distinguished separately from the rest, and the child may properly be said to have compassion. The same sources of compassion remain, though with some alteration, during our whole progress through life. This is so evident, that a reflecting person may plainly discern the constituent parts of his compassion while they are yet the mere internal, and, as one may say, selfish feelings above mentioned; and before they have put on the nature of compassion by a coalescence with the rest. Agreeably to this method of reasoning, it may be observed, that persons whose nerves are easily irritable, and those who have experienced great trials and afflictions, are in general more disposed to compassion than others; and that we are most apt to pity others in those diseases and calamities which we either have felt or of which we apprehend ourselves to be in danger."

The origin of patriotism and public spirit is thus traced by Dr Sayers: "The pleasures which our country affords are numerous and great. The wish to perpetuate the enjoyment of these pleasures, includes the wish to promote the safety and welfare of our country, without which many of them would be lost. All this is evidently selfish; but, as in the progress of gratitude, it finally becomes disinterested. Pleasant ideas are thus strongly connected with the welfare of our country, after the tie which first bound them together has escaped our notice. The prosperity which was at first desirable as the means of future enjoyment, becomes itself an end: we feel delight in such prosperity, however produced; and we look not beyond this immediate delight. It is thus not difficult to observe in what manner a general and disinterested benevolence takes place in a mind which has already received pleasure from the happiness of a few; the transition is easy towards associating it with *happiness in general*, with the happiness of any being, whether produced by ourselves or by any other cause whatever."

* Warburton.

From this reasoning, our author concludes, that all our passions may be traced up to original feelings of regard for ourselves. "Thus (in the forcible language of a learned writer * of the same school) does self-love, under the varying appearance of natural affection, domestic relation, and the connexions of social habitude, at first work blindly on, obscure and deep in dirt: But as it makes its way, it continues rising, till it emerges into light; and then suddenly expiring, leaves behind it the fairest issue,"—benevolent affection.

> Self-love partook the path it first pursu'd,
> And found the private in the public good.

† Dr Pri Review, &c.

Thus have we stated the two opposite theories respecting the origin of passions in the mind, and given our readers a short specimen of the reasonings by which they are supported by their respective patrons. Were we called upon to decide between them, we should be tempted to say, that they have both been carried to extremes by some of their advocates, and that the truth lies in the middle between them. "It is impossible † but that creatures capable of pleasant and painful sensations, should love and choose the one, and dislike and avoid the other. No being who knows what happiness and misery are, can be supposed indifferent to them, without a plain contradiction. Pain is not a *possible* object of desire, nor happiness of *aversion*."—To prefer a greater good though distant, to a less good that is present; or to choose a present evil, in order to avoid a greater future evil—is indeed wise and rational conduct; but to choose evil ultimately, is absolutely impossible. Thus far then must be admitted, that every being possessed of sense and intellect, necessarily desires his own good as soon as he knows what it is; but if this knowledge be not innate, neither can the desire. Every human being comes into the world with a capability of knowledge, and of course with a capability of affections, desires, and passions; but it seems not to be conceivable how he can actually love, or hate, or dread any thing, till he know whether it be good, or ill, or dangerous. If, therefore, we have no innate ideas, we cannot possibly have innate desires or aversions. Those who contend that we have, seem to think, that without them reason would be insufficient, either for the preservation of the individual or the continuation of the species; and some writers have alleged, that if our affections and passions were the mere result of early associations, they would necessarily be more capricious than we ever find them. But this objection seems to arise from their not rightly understanding the theory of their antagonists. The disciples of Locke and Hartley do not suppose it possible for any man in society to prevent such associations from being formed in his mind as shall necessarily produce desires and aversions; far less do they think it possible to form associations of ideas utterly repugnant, so as to desire that as good which his senses and intellect have experienced to be evil. Associations are formed by the very same means, and at the very same time, that ideas and notions are impressed upon the mind; but as pain is never mistaken for pleasure by the senses, so an object which has given us only pain, is never associated with any thing that makes it desireable. We say an object that has given us only pain, because it is possible to form such an association between life and the loss of a limb, as to make us grateful to the surgeon by whom it was amputated. Associations being formed according to the same laws by which knowledge is acquired, it by no means follows that passions resulting from them should be more capricious than they are found to be; and they certainly are sufficiently capricious to make us suspect that the greater part of them has this origin, rather than that they are all infused in the mind by the immediate agency of the

Creator. If a man be a being formed with no innate ideas, and with no other instinctive principles of action than what are absolutely necessary to preserve his existence and perpetuate the species, it is easy to perceive why he is placed in this world as in a state of probation, where he may acquire habits of virtue to fit him for a better. It is likewise easy to perceive why some men are better than others, and why some are the slaves of the most criminal passions. But all this is unintelligible, upon the supposition that the seeds of every passion are innate, and that man is a compound of reason and of instincts so numerous and various as to suit every circumstance in which it can be placed.

If passions, whatever be their origin, operate instantaneously, and if they be formed according to fixed laws, it may be thought a question of very little importance whether they be instinctive or acquired.—This was long our own opinion; but we think, that upon maturer reflection we have seen reason to change it. If passions be the result of early associations, it is of the utmost consequence that no improper associations be formed in the minds of children, and that none of their unreasonable desires be gratified. Upon this theory it seems indeed to depend almost wholly upon education, whether a child shall become a calm, benevolent, steady, and upright man; or a passionate, capricious, selfish miscreant. By teaching him to resent every petty injury, the seeds of irascibility are sown in his mind, and take such root, that before the age of manhood he becomes intolerable to all with whom he must converse. By exciting numberless desires in his youthful mind, and instantly gratifying them, you make him capricious and impatient of disappointment; and by representing other children as in any degree inferior to him, you inspire him with the hateful passion of pride. According to the instinctive theory, education can only augment or diminish the strength of passions; according to the other theory, it is the source of by far the greater part of them. On either supposition, parents should watch with solicitude over the actions of their children; but they will surely think themselves obliged to be doubly watchful, if they believe, that through their neglect their children may acquire hateful passions, to which, if properly educated, they might have remained strangers through their whole lives. And let it be remembered, that this solicitude should begin at an early period; because the mind is susceptible of deep associations much sooner than is sometimes imagined. Without this susceptibility, no language could be learned; and therefore a child by the time he learns to speak, may have planted in his mind the seeds of passions, on the just regulation and subordination of which depends in a great measure the happiness of mankind. See *Moral Philosophy*, Part I. chap. 1. & 2. Part III. N° 216.

Passions and Emotions, difference between them. See *Emotions and Passions*.

External Signs of Emotions and Passions. So intimately connected are the soul and body, that every agitation in the former produces a visible effect upon the latter. There is, at the same time, a wonderful uniformity in that operation; each class of emotions and passions being invariably attended with an external appearance peculiar to itself. These external appearances, or signs, may not improperly be considered as a natural language, expressing to all beholders emotions and passions as they rise in the heart. Hope, fear, joy, grief, are displayed externally: the character of a man can be read in his face; and beauty, which makes so deep an impression, is known to result, not so much from regular features and a fine complexion, as from good nature, good sense, sprightliness, sweetness, or other mental quality, expressed upon the countenance. Though perfect skill in that language be rare, yet what is generally known is sufficient for the ordinary purposes of life. But by what means we come to understand the language, is a point of some intricacy. It cannot be by sight merely; for upon the most attentive inspection of the human visage, all that can be discerned are, figure, colour, and motion, which, singly or combined, never can represent a passion nor a sentiment: the external sign is indeed visible; but to understand its meaning, we must be able to connect it with the passion that causes it; an operation far beyond the reach of eye-sight. Where then is the instructor to be found that can unveil this secret connexion? If we apply to experience, it is yielded, that from long and diligent observation, we may gather, in some measure, in what manner those we are acquainted with express their passions externally; but with respect to strangers, we are left in the dark; and yet we are not puzzled about the meaning of these external expressions in a stranger, more than in a bosom companion. Further, Had we no other means but experience for understanding the external signs of passion, we could not expect any uniformity, nor any degree of skill, in the bulk of individuals; yet matters are so much better ordered, that the external expressions of passion form a language understood by all, by the young as well as the old, by the ignorant as well as the learned: We talk of the plain and legible characters of that language: for undoubtedly we are much indebted to experience, in deciphering the dark and more delicate expressions. Where then shall we apply for a solution of this intricate problem, which seems to penetrate deep into human nature? Undoubtedly if the meaning of external signs be not derived to us from sight, nor from experience, there is no remaining source when it can be derived but from nature.

Elements of Criticism.

We may then venture to pronounce, with some degree of confidence, that man is provided by nature with a sense or faculty that lays open to him every passion by means of its external expressions. And we cannot entertain any reasonable doubt of this, when we reflect, that the meaning of external signs is not hid even from infants; an infant is remarkably affected with the passions of its nurse expressed on her countenance; a smile cheers it, a frown makes it afraid: but fear cannot be without apprehending danger; and what danger can the infant apprehend, unless it be sensible that its nurse is angry? We must therefore admit, that a child can read anger in its nurse's face; of which it must be sensible intuitively, for it has no other mean of knowledge. We do not affirm, that these particulars are clearly apprehended by the child; for to produce clear and distinct perceptions, reflection and experience are requisite: but that even an infant, when afraid, must have some notion of its being in danger, is evident.

That we should be conscious intuitively of a passion from its external expressions, is conformable to the analogy of nature: the knowledge of that language is of too great importance to be left upon experience; because

Passion.

a foundation so uncertain and precarious, would prove a great obstacle to the formation of societies. Wisely therefore is it ordered, and agreeably to the system of Providence, that we should have nature for our instructor.

Such is the philosophy of Lord Kames, to which objections unanswerable may be made. It is part of the instinctive system of metaphysics, which his lordship has carried farther than all who wrote before him, and perhaps farther than all who have succeeded him in this department of science. That a child intuitively reads anger in its nurse's face, is so far from being true, that for some short time after birth it is not terrified by the most menacing gestures. It is indeed absolutely incapable of fear till it has suffered pain, (see INSTINCT); and could we constantly caress it with what is called an *angry look*, it would be cheered by that look, and frightened at a smile. It feels, however, the *effects* of anger, and is soon capable of observing the peculiarity of feature with which that passion is usually accompanied; and these two become in a short time so linked together in its tender mind, that the appearance of the one naturally suggests to it the reality of the other.

Should it be said that a loud and sudden noise startles a child immediately after birth, and that, therefore, the infant must be instinctively afraid, the fact may be admitted, without any necessity of admitting the inference. The nerves of an infant are commonly very irritable, and the strong impulse on the *auditory* nerves may agitate its whole frame, without inspiring it with the passion of fear. The loud noise is in all probability not the sign of approaching danger, but the immediate cause of real pain, from which the infant shrinks as it would from the prick of a pin or the scorching of a candle. But we have said enough in the article immediately preceding, and in others which are there quoted, to show how the passions may be formed by associations even in early infancy, and yet operate as if they were instinctive. This being the case, we shall through the remainder of this article suffer his lordship to speak his own language, without making any further remarks upon it. We are induced to do this for two reasons; of which the first is, that many of our readers will probably prefer his theory to ours; and the second is, that his conclusions respecting the signs and language of passion hold equally good from either theory.

We perfectly agree with him, that manifold and admirable are the purposes to which the external signs of passion are made subservient by the Author of our nature.

1. The signs of internal agitation displayed externally to every spectator, tend to fix the signification of many words. The only effectual means to ascertain the meaning of any doubtful word, is an appeal to the thing it represents: and hence the ambiguity of words expressive of things that are not objects of external sense; for in that case an appeal is denied. Passion, strictly speaking, is not an object of external sense: but its external signs are: and by means of these signs, passions may be appealed to with tolerable accuracy; thus the words that denote our passions, next to those that denote external objects, have the most distinct meaning. Words signifying internal action and the more delicate feelings, are less distinct. This defect, with regard to internal action, is what chiefly occasions the intricacy of logic: the terms of that science are far from being sufficiently ascertained, even after much care and labour bestowed by an eminent writer †; to whom, however, the world is greatly indebted, for removing a mountain of rubbish, and moulding the subject into a rational and correct form. The same defect is remarkable in criticism, which has for its object the more delicate feelings; the terms that denote these feelings being not more distinct than those of logic.

2. Society among individuals is greatly promoted by that universal language. Looks and gestures give direct access to the heart; and leads us to select, with tolerable accuracy, the persons who are worthy of our confidence. It is surprising how quickly, and for the most part how correctly, we judge of character from external appearance.

3. After social intercourse is commenced, these external signs, which diffuse through a whole assembly the feelings of each individual, contribute above all other means to improve the social affections. Language, no doubt, is the most comprehensive vehicle for communicating emotions: but in expedition, as well as in power of conviction, it falls short of the signs under consideration; the involuntary signs especially, which are incapable of deceit. Where the countenance, the tones, the gestures, the actions, join with the words in communicating emotions, these united have a force irresistible. Thus all the pleasant emotions of the human heart, with all the social and virtuous affections, are, by means of these external signs, not only perceived, but felt. By this admirable contrivance, conversation becomes that lively and animating amusement, without which life would at best be insipid: one joyful countenance spreads cheerfulness instantaneously through a multitude of spectators.

4. Dissocial passions, being hurtful by prompting violence and mischief, are noted by the most conspicuous external signs, in order to put us upon our guard: thus anger and revenge, especially when sudden, display themselves on the countenance in legible characters. The external signs, again, of every passion that threatens danger, raise in us the passion of fear: which frequently operating without reason or reflection, moves us by a sudden impulse to avoid the impending danger.

5. These external signs are remarkably subservient to morality. A painful passion, being accompanied with disagreeable external signs, must produce in every spectator a painful emotion: but then, if the passion be social, the emotion it produces is attractive, and connects the spectator with the person who suffers. Dissocial passions only are productive of repulsive emotions, involving the spectator's aversion, and frequently his indignation. This artful contrivance makes us cling to the virtuous, and abhor the wicked.

6. Of all the external signs of passion, those of affliction or distress are the most illustrious with respect to a final cause, and deservedly merit a place of distinction. They are illustrious by the singularity of their contrivance; and also by inspiring sympathy, a passion to which human society is indebted for its greatest blessing, that of providing relief for the distressed. A subject so interesting deserves a leisurely and attentive examination. The conformity of the nature of man to his external circumstance is in every particular wonderful: his nature makes him prone to society; and society is necessary to his wellbeing, because in a solitary state he is a helpless being,

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being destitute of support, and in his distresses destitute of relief: but mental support, the shining attribute of society, is of too great moment to be left dependent upon cool reason; it is ordered more wisely, and with greater conformity to the analogy of nature, that it should be enforced even instinctively by the passion of sympathy. Here sympathy makes a capital figure; and contributes, more than any other means, to make life easy and comfortable. But however essential the sympathy of others may be to our well-being, one beforehand would not readily conceive how it could be raised by external signs of distress; for considering the analogy of nature, if these signs be agreeable, they must give birth to a pleasant emotion, leading every beholder to be pleased with human woes: if disagreeable, as they undoubtedly are, ought they not naturally to repel the spectator from them, in order to be relieved from pain? Such would be the reasoning beforehand; and such would be the effect were man purely a selfish being. But the benevolence of our nature gives a very different direction to the painful passion of sympathy, and to the desire involved in it: instead of avoiding distress, we fly to it in order to afford relief; and our sympathy cannot be otherwise gratified but by giving all the succour in our power. Thus external signs of distress, though disagreeable, are attractive; and the sympathy they inspire is a powerful cause, impelling us to afford relief even to a stranger, as if he were our friend or relation.

It is a noted observation, that the deepest tragedies are the most crowded; which in an overly view will be thought an unaccountable bias in human nature. Love of novelty, desire of occupation, beauty of action, make us fond of theatrical representations; and when once engaged, we must follow the story to the conclusion, whatever distress it may create. But we generally become wise by experience, and when we foresee what pain we shall suffer during the course of the representation, is it not surprising that persons of reflection do not avoid such spectacles altogether? And yet one who has scarce recovered from the distress of a deep tragedy, resolves coolly and deliberately to go to the very next, without the slightest obstruction from self-love. The whole mystery is explained by a single observation: That sympathy, though painful, is attractive; and attaches us to an object in distress, instead of prompting us to fly from it. And by this curious mechanism it is, that persons of any degree of sensibility are attracted by affliction still more than by joy.

To conclude: the external signs of passion are a strong indication, that man, by his very constitution, is framed to be open and sincere. A child, in all things obedient to the impulses of nature, hides none of its emotions; the savage and clown, who have no guide but pure nature, expose their hearts to view, by giving way to all the natural signs. And even when men learn to dissemble their sentiments, and when behaviour degenerates into art, there still remain checks, that keep dissimulation within bounds, and prevent a great part of its mischievous effects: the total suppression of the voluntary signs during any vivid passion, begets the utmost uneasiness, which cannot be endured for any considerable time: this operation becomes indeed less painful by habit; but luckily the involuntary signs cannot, by any effort, be suppressed or even dissembled. An absolute hypocrisy, by which the character is concealed and a fictitious one assumed, is made impracticable; and nature has thereby prevented much harm to society. We may pronounce, therefore that Nature, herself sincere and candid, intends that mankind should preserve the same character, by cultivating simplicity and truth, and banishing every sort of dissimulation that tends to mischief.

Influence of PASSION *with respect to our Perceptions, Opinions, and Belief.* So intimately are our perceptions, passions, and actions, connected, it would be wonderful if they should have no mutual influence. That our actions are too much influenced by passion, is a known truth; but it is not less certain, though not so well known, that passion hath also an influence upon our perceptions, opinions, and belief. For example, the opinions we form of men and things are generally directed by affection: An advice given by a man of figure has great weight; the same advice from one in a low condition is despised or neglected: a man of courage underrates danger; and to the indolent the slightest obstacle appears unsurmountable. All this may be accounted for by the simple principle of association.

There is no truth more universally known, than that tranquillity and sedateness are the proper state of mind for accurate perception and cool deliberation; and for that reason, we never regard the opinion even of the wisest man, when we discover prejudice or passion behind the curtain. Passion hath such influence over us, as to give a false light to all its objects. Agreeable passions prepossess the mind in favour of their objects; and disagreeable passions, not less againt their objects: A woman is all perfection in her lover's opinion, while in the eye of a rival beauty she is awkward and disagreeable: when the passion of love is gone, beauty vanishes with it;—nothing is left of that genteel motion, that sprightly conversation, those numberless graces, which formerly, in the lover's opinion, charmed all hearts. To a zealot every one of his own sect is a saint, while the most upright of a different sect are to him children of perdition: the talent of speaking in a friend, is more regarded than prudent conduct in any other. Nor will this surprise any one acquainted with the world; our opinions, the result frequently of various and complicated views, are commonly so slight and wavering, as readily to be susceptible of a bias from passion.

With that natural bias another circumstance concurs, to give passion an undue influence on our opinions and belief; and that is a strong tendency in our nature to justify our passions as well as our actions, not to others only, but even to ourselves. That tendency is peculiarly remarkable with respect to disagreeable passions; by its influence, objects are magnified or lessened, circumstances supplied or suppressed, every thing coloured and disguised to answer the end of justification. Hence the foundation of self-deceit, where a man imposes upon himself innocently, and even without suspicion of a bias.

We proceed to illustrate the foregoing observations by proper examples.

Gratitude, when warm, is often exerted upon the children of the benefactor; especially where he is removed out of reach by death or absence. The passion in this case being exerted for the sake of the benefactor, requires no peculiar excellence in his children: but the practice of doing good to these children produces affection

tion for them, which never fails to advance them in our esteem. By such means, strong connections of affection are often formed among individuals, upon the slight foundation now mentioned.

Envy is a passion, which, being altogether unjustifiable, cannot be excused but by disguising it under some plausible name. At the same time, no passion is more eager than envy to give its object a disagreeable appearance: it magnifies every bad quality, and fixes on the most humiliating circumstances:

Cassius. I cannot tell what you and other men
Think of this life; but for my single self,
I had as lief not be, as live to be
In awe of such a thing as I myself.
I was born free as Cæsar, so were you;
We both have fed as well, and we can both
Endure the winter's cold as well as he.
For once, upon a raw and gusty day,
The troubled Tyber chafing with his shores,
Cæsar says to me, Dar'st thou, Casssius, now
Leap in with me into this angry flood,
And swim to yonder point?—Upon the word,
Accoutred as I was, I plunged in,
And bid him follow; so indeed he did.
The torrent roar'd, and we did buffet it
With lusty sinews; throwing it aside,
And stemming it with hearts of controversy.
But ere we could arrive the point propos'd,
Cæsar cry'd, Help me, Cassius, or I sink.
I, as Æneas, our great ancestor,
Did from the flames of Troy upon his shoulder
The old Anchises bear; so from the waves of Tyber
Did I the tired Cæsar: and this man
Is now become a god; and Cassius is
A wretched creature, and must bend his body
If Cæsar carelessly but nod on him.
He had a fever when he was in Spain;
And when the fit was on him, I did mark
How he did shake. 'Tis true, this god did shake;
His coward lips did from their colour fly;
And that same eye whose bend doth awe the world
Did lose its lustre: I did hear him groan;
Ay, and that tongue of his, that bade the Romans
Mark him, and write his speeches in their books,
Alas! it cry'd—Give me some drink, Titinius,—
As a sick girl. Ye Gods, it doth amaze me,
A man of such a feeble temper should
So get the start of the majestic world,
And bear the palm alone. *Julius Cæsar*, act ii. sc. 3.

Gloster, inflamed with resentment against his son Edgar, could even force himself into a momentary conviction that they were not related:

O strange fasten'd villain!
Would he deny his letter?—I never got him.
King Lear, act ii. sc. 3.

When by great sensibility of heart, or other means, grief becomes immoderate, the mind, in order to justify itself, is prone to magnify the cause; and if the real cause admit not of being magnified, the mind seeks a cause for its grief in imagined future events:

Busby. Madam, your majesty is much too sad:
You promis'd, when you parted with the king,
To lay aside self-harming heaviness,
And entertain a cheerful disposition.
Queen. To please the king, I did; to please myself,
I cannot do it. Yet I know no cause
Why I should welcome such a guest as grief;
Save bidding farewell to so sweet a guest
As my sweet Richard: yet again, methinks,
Some unborn sorrow, ripe in Fortune's womb,
Is coming tow'rd me; and my inward soul
With something trembles, yet at nothing grieves,
More than with parting from my lord the king.
Richard II. act ii. sc. 5.

Resentment at first is vented on the relations of the offender, in order to punish him; but as resentment, when so outrageous, is contrary to conscience, the mind, to justify its passion, is disposed to paint these relations in the blackest colours; and it comes at last to be convinced, that they ought to be punished for their own demerits.

Anger, raised by an accidental stroke upon a tender part of the body, is sometimes vented upon the undesigning cause. But as the passion in that case is absurd, and as there can be no solid gratification in punishing the innocent, the mind, prone to justify as well as to gratify its passion, deludes itself into a conviction of the action's being voluntary. The conviction, however, is but momentary; the first reflection shows it to be erroneous; and the passion vanisheth almost instantaneously with the conviction. But anger, the most violent of all passions, has still greater influence: it sometimes forces the mind to personify a stock or a stone if it happen to occasion bodily pain, and even to believe it a voluntary agent, in order to be a proper object of resentment. And that we have really a momentary conviction of its being a voluntary agent, must be evident from considering, that without such conviction the passion can neither be justified nor gratified: the imagination can give no aid; for a stock or a stone imagined insensible, cannot be an object of punishment, if the mind be conscious that it is an imagination merely without any reality (A). Of such personification, involving a conviction of reality, there is one illustrious instance. When the first bridge of boats over the Hellespont was destroyed by a storm, Xerxes fell into a transport of rage, so excessive, that he commanded the sea to be punished with 300 stripes; and a pair of fetters to be thrown into it, enjoining the following words to be pronounced: "O thou salt and bitter water! thy master hath condemned thee to this punishment for offending him without cause; and is resolved

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(A) We have already shown how a man may be instigated to wreak his vengeance on a stock or stone, without ever considering whether it be sensible or insensible: (See Passion). If the story of Xerxes be true, he may have considered the sea as sensible and animated, without dreaming that a stock or a stone is so. The sea was a god among many of the pagans, and was considered as such by Xerxes, otherwise he could not have applauded men for not sacrificing to it.

resolved to pass over thee in despite of thy insolence: with reason all men neglect to sacrifice to thee, because thou art both disagreeable and treacherous."

Shakespeare exhibits beautiful examples of the irregular influence of passion in making us believe things to be otherwise than they are. King Lear, in his distress, personifies the rain, wind, and thunder; and in order to justify his resentment, believes them to be taking part with his daughters:

Lear. Rumble thy bellyful, spit fire, spout rain!
Nor rain, wind, thunder, fire, are my daughters.
I tax not you, ye elements, with unkindness;
I never gave you kingdoms, call'd you children;
You owe me no subscription. Then let fall
Your horrible pleasure.—Here I stand, your brave;
A poor, infirm, weak, and despised old man!
But yet I call you servile ministers,
That have with two pernicious daughters join'd
Your high-engender'd battles 'gainst a head
So old and white as this. Oh! oh! 'tis foul!
Act iii. sc. 2.

King Richard, full of indignation against his favourite horse for carrying Bolingbroke, is led into the conviction of his being rational:

Groom. O, how it yearn'd my heart, when I beheld
In London streets, that coronation-day,
When Bolingbroke rode on Roan Barbary,
That horse that thou so often hast bestrid,
That horse that I so carefully have dressed.
K. Rich. Rod he on Barbary? tell me, gentle friend,
How went he under him?
Groom. So proudly as he had disdain'd the ground.
K. Rich. So proud that Bolingbroke was on his back!
That jade had eat bread from my royal hand.
This hand hath made him proud with clapping him.
Would he not stumble? would he not fall down,
(Since pride must have a fall), and break the neck
Of that proud man that did usurp his back?
Richard II. act v. sc. 11.

Hamlet, swelled with indignation at his mother's second marriage, was strongly inclined to lessen the time of her widowhood, the shortness of the time being a violent circumstance against her; and he deludes himself by degrees into the opinion of an interval shorter than the real one:

Hamlet. ——————That it should come to this!
But two months dead! nay, not so much; not two—
So excellent a king, that was, to this,
Hyperion to a satyr: so loving to my mother,
That he permitted not the wind of heav'n
Visit her face too roughly. Heav'n and earth!
Must I remember—why, she would hang on him,
As if increase of appetite had grown
By what it fed on: yet, within a month——
Let me not think—Frailty, thy name is *Woman!*
A little month! or ere those shoes were old,
With which she follow'd my poor father's body,
Like Niobe, all tears——why she, ev'n she—
(O heav'n! a beast, that wants discourse of reason,
Wou'd have mourn'd longer) married with mine uncle,
My father's brother; but no more like my father
Than I to Hercules. Within a month!—
Ere yet the salt of most unrighteous tears
Had left the flushing in her galled eyes,
She married——Oh, most wicked speed! to post
With such dexterity to incestuous sheets!
It is not, nor it cannot, come to good.
But break, my heart, for I must hold my tongue.
Act i. sc. 3.

The power of passion to falsify the computation of time is remarkable in this instance; because time, having an accurate measure, is less obsequious to our desires and wishes, than objects which have no precise standard of magnitude.

Good news are greedily swallowed upon very slender evidence; our wishes magnify the probability of the event, as well as the veracity of the relater; and we believe as certain what at best is doubtful:

Quel, che l'huom vede, amor li fa invisible
E l' invisibil fa veder amore.
Questo credute fu, che l' miser suole
Dar facile credenza a' quel, che vuole.
Orland. Furios. cant. 1st. 56.

For the same reason, bad news gain also credit upon the slightest evidence: fear, if once alarmed, has the same effect with hope, to magnify every circumstance that tends to conviction. Shakespeare, who shows more knowledge of human nature than any of our philosophers, hath in his Cymbeline represented this bias of the mind; for he makes the person who alone was affected with the bad news, yield to evidence that did not convince any of his companions. And Othello is convinced of his wife's infidelity from circumstances too slight to move any person less interested.

If the news interest us in so low a degree as to give place to reason, the effect will not be altogether the same: judging of the probability or improbability of the story, the mind settles in a rational conviction either that it is true or not. But even in that case, the mind is not allowed to rest in that degree of conviction which is produced by rational evidence: if the news be in any degree favourable, our belief is raised by hope to an improper height; and if unfavourable, by fear.

This observation holds equally with respect to future events: if a future event be either much wished or dreaded, the mind never fails to augment the probability beyond truth.

That easiness of belief, with respect to wonders and prodigies, even the most absurd and ridiculous, is a strange phenomenon; because nothing can be more evident than the following proposition, That the more singular any event is, the more evidence is required to produce belief: a familiar event daily occurring, being in itself extremely probable, finds ready credit, and therefore is vouched by the slightest evidence; but to overcome the improbability of a strange and rare event, contrary to the course of nature, the very strongest evidence is required. It is certain, however, that wonders and prodigies are swallowed by the vulgar, upon evidence that would not be sufficient to ascertain the most familiar occurrence. It has been reckoned difficult to explain that irregular bias of mind; but we are now made acquainted with the influence of passion upon opinion and belief; a story of ghosts or fairies, told with an air of gravity and truth, raiseth an emotion of wonder, and perhaps of dread; and these emotions imposing on a weak mind, impress upon it a thorough conviction contrary to reason.

Opinion and belief are influenced by propensity as well as by passion. An innate propensity is all we have to convince us that the operations of nature are uniform: influenced by that propensity, we often rashly think, that good or bad weather will never have an end; and in natural philosophy, writers, influenced by the same propensity, stretch commonly their analogical reasonings beyond just bounds. See METAPHYSICS, N° 133, 134.

Opinion and belief are influenced by affection as well as by propensity. The noted story of a fine lady and a curate viewing the moon through a telescope is a pleasant illustration: "I perceive (says the lady) two shadows inclining to each other; they are certainly two happy lovers:" "Not at all (replies the curate), they are two steeples of a cathedral."

Language of PASSION. Among the particulars that compose the social part of our nature, a propensity to communicate our opinions, our emotions, and every thing that affects us, is remarkable. Bad fortune and injustice affect us greatly; and of these we are so prone to complain, that if we have no friend or acquaintance to take part in our sufferings, we sometimes utter our complaints aloud, even when there are none to listen.

But this propensity operates not in every state of mind. A man immoderately grieved, seeks to afflict himself, rejecting all consolation: immoderate grief accordingly is mute; complaining is struggling for consolation.

It is the wretch's comfort still to have
Some small reserve of near and inward wo,
Some unsuspected hoard of inward grief,
Which they unseen may wail, and weep, and mourn,
And glutton-like alone devour.

Mourning Bride, act i. sc. 1.

When grief subsides, it then, and no sooner, finds a tongue: we complain, because complaining is an effort to disburden the mind of its distress. This observation is finely illustrated by a story which Herodotus records, book iii. Cambyses, when he conquered Egypt, made Psammeticus the king prisoner; and for trying his constancy, ordered his daughter to be dressed in the habit of a slave, and to be employed in bringing water from the river; his son also was led to execution with a halter about his neck. The Egyptians vented their sorrow in tears and lamentations: Psammeticus only, with a downcast eye, remained silent. Afterward meeting one of his companions, a man advanced in years, who, being plundered of all, was begging alms, he wept bitterly, calling him by his name. Cambyses, struck with wonder, demanded an answer to the following question: "Psammeticus, thy master Cambyses is desirous to know, why, after thou hadst seen thy daughter so ignominiously treated, and thy son led to execution, without exclaiming or weeping, thou shouldst be so highly concerned for a poor man noway related to thee?" Psammeticus returned the following answer: "Son of Cyrus, the calamities of my family are too great to leave me the power of weeping; but the misfortunes of a companion, reduced in his old age to want of bread, is a fit subject for lamentation."

Surprise and terror are silent passions, for a different reason: they agitate the mind so violently, as for a time to suspend the exercise of its faculties, and among others the faculty of speech.

Love and revenge, when immoderate, are not more loquacious than immoderate grief. But when these passions become moderate, they set the tongue free, and like moderate grief, become loquacious. Moderate love, when unsuccessful, is vented in complaints; when successful, is full of joy expressed by words and gestures.

As no passion hath any long uninterrupted existence, nor beats always with an equal pulse, the language suggested by passion is not only unequal but frequently interrupted; and even during an uninterrupted fit of passion, we only express in words the more capital sentiments. In familiar conversation, one who vents every single thought, is justly branded with the character of *loquacity;* because sensible people express no thoughts but what make some figure: in the same manner, we are only disposed to express the strongest impulses of passion, especially when it returns with impetuosity after interruption.

It is elsewhere observed * that the sentiments ought to be tuned to the passion, and the language to both. Elevated sentiments require elevated language: tender sentiments ought to be clothed in words that are soft and flowing: when the mind is depressed with any passion, the sentiments must be expressed in words that are humble, not low. Words being intimately connected with the ideas they represent, the greatest harmony is required between them: to express, for example, an humble sentiment in high-sounding words, is disagreeable by a discordant mixture of feelings; and the discord is not less when elevated sentiments are dressed in low words:

Versibus exponi tragicis res comica non vult.
Indignatur item privatis ac prope socco
Dignis carminibus narrari cœna Thyestæ.

HORAT. *Ars Poet.* l. 89.

This, however, excludes not figurative expression, which, within moderate bounds, communicates to the sentiment an agreeable elevation. We are sensible of an effect directly opposite, where figurative expression is indulged beyond a just measure: the opposition between the expression and the sentiment makes the discord appear greater than it is in reality.

At the same time, figures are not equally the language of every passion: pleasant emotions, which elevate or swell the mind, vent themselves in strong epithets and figurative expression; but humbling and dispiriting passions affect to speak plain:

Et tragicus plerumque dolet sermone pedestri.
Telephus et Peleus, cum pauper et exul uterque,
Projicit ampullas et sesquipedalia verba,
Si curat cor spectantis tetigisse querela.

HORAT. *Ars Poet.* 95.

Figurative expression, being the work of an enlivened imagination, cannot be the language of anguish or distress. Otway, sensible of this, has painted a scene of distress in colours finely adapted to the subject: there is scarcely a figure in it, except a short and natural simile with which the speech is introduced. Belvidera, talking to her father of her husband:

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* See article *timent.*

Think you saw what past at our last parting ;
Think you beheld him like a raging lion,
Pacing the earth, and tearing up his steps,
Fate in his eyes, and roaring with the pain,
Of burning fury ; think you saw his one hand
Fix'd on my throat, while the extended other
Grasp'd a keen threat'ning dagger : oh, 'twas thus
We last embrac'd, when, trembling with revenge,
He dragg'd me to the ground, and at my bosom
Presented horrid death ; cry'd out, My friends !
Where are my friends ? swore, wept, rag'd, threaten'd, lov'd ;
For he yet lov'd, and that dear love preserv'd me
To this last trial of a father's pity.
I fear not death, but cannot bear a thought
That that dear hand should do th' unfriendly office.
If I was ever then your care, now hear me ;
Fly to the senate, save the promis'd lives
Of his dear friends, ere mine be made the sacrifice.
Venice Preserved, Act v.

To preserve the foresaid resemblance between words and their meaning, the sentiments of active and hurrying passions ought to be dressed in words where syllables prevail that are pronounced short or fast ; for these make an impression of hurry and precipitation. Emotions, on the other hand, that rest upon their objects, are best expressed by words where syllables prevail that are pronounced long or slow. A person affected with melancholy, has a languid and slow train of perceptions. The expression best suited to that state of mind, is where words, not only of long, but of many syllables, abound in the composition ; and for that reason, nothing can be finer than the following passage :

In those deep solitudes, and awful cells,
Where heav'nly-pensive Contemplation dwells,
And ever-musing Melancholy reigns.
POPE, *Eloisa to Abelard*.

To preserve the same resemblance, another circumstance is requisite, that the language, like the emotion, be rough or smooth, broken or uniform. Calm and sweet emotions are best expressed by words that glide softly : surprise, fear, and other turbulent passions, require an expression both rough and broken.

It cannot have escaped any diligent inquirer into nature, that, in the hurry of passion, one generally expresses that thing first which is most at heart ; which is beautifully done in the following passage :

Me, Me ; adsum qui feci : in me convertite ferrum,
O Rutuli, mea fraus omnis. *Æneid*, ix. 427.

Passion has often the effect of redoubling words, the better to make them express the strong conception of the mind. This is finely imitated in the following examples.

————————Thou sun, said I, fair light !
And thou enlighten'd earth, so fresh and gay !
Ye hills and dales, ye rivers, woods, and plains !
And ye that live, and move, fair creatures ! tell,
Tell, if ye saw, how came I thus, how here.—
Paradise Lost, viii. 273.

————————Both have sinn'd ! but thou
Against God only ; I, 'gainst God and thee ;
And to the place of judgment will return ;
There with my cries importune Heav'n, that all
The sentence, from thy head remov'd, may light
On me, sole cause to thee of all this wo ;
Me ! me ! only just object of his ire.
Paradise Lost, x. 930.

In general, the language of violent passion ought to be broken and interrupted. Soliloquies ought to be so in a peculiar manner : language is intended by nature for society ; and a man when alone, though he always clothes his thoughts in words, seldom gives his words utterance, unless when prompted by some strong emotion ; and even then by starts and intervals only. Shakespeare's soliloquies may be justly established as a model ; for it is not easy to conceive any model more perfect. Of his many incomparable soliloquies, the two following only shall be quoted, being different in their manner.

Hamlet. Oh, that this too, too solid flesh would melt,
Thaw, and resolve itself into a dew !
Or that the Everlasting had not fix'd
His canon 'gainst self-slaughter ! O God ! O God !
How weary, stale, flat, and unprofitable,
Seem to me all the uses of this world !
Fie on't ! O fie ! 'tis an unweeded garden,
That grows to seed : things rank and gross in nature
Possess it merely.——That it should come to this !
But two months dead ! nay, not so much ; not two—
So excellent a king, that was, to this,
Hyperion to a satyr : so loving to my mother,
That he permitted not the winds of heav'n
Visit her face too roughly. Heav'n and earth !
Must I remember—why, she would hang on him,
As if increase of appetite had grown
By what it fed on : yet, within a month——
Let me not think—Frailty, thy name is *Woman !*
A little month ! or ere those shoes were old,
With which she follow'd my poor father's body,
Like Niobe, all tears———why she, even she——
(O heav'n ! a beast, that wants discourse of reason,
Would have mourn'd longer—) married with mine uncle,
My father's brother ; but no more like my father
Than I to Hercules. Within a month !——
Ere yet the salt of most unrighteous tears
Had left the flushing in her galled eyes,
She married———Oh, most wicked speed, to post
With such dexterity to incestuous sheets !
It is not, nor it cannot come to good.
But break, my heart, for I must hold my tongue.
Hamlet, Act i. sc. 3.

" *Ford*. Hum ! ha ! is this a vision ? is this a dream ?
" do I sleep ? Mr Ford, awake ; awake, Mr Ford ;
" there's a hole made in your best coat, Mr Ford ! this
" 'tis to be married ! this 'tis to have linen and buck
" baskets ! Well, I will proclaim myself what I am ;

"I will now take the leacher; he is at my house; "he cannot 'scape me; 'tis impossible he should; he "cannot creep into a halfpenny purse, nor into a pepper-box. But lest the devil that guides him should "aid him, I will search impossible places; tho' what I "am I cannot avoid, yet to be what I would not, shall "not make me tame."

Merry Wives of Windsor, act iii. sc. last.

These soliloquies are accurate and bold copies of nature: in a passionate soliloquy one begins with thinking aloud, and the strongest feelings only are expressed; as the speaker warms, he begins to imagine one listening, and gradually slides into a connected discourse.

How far distant are soliloquies generally from these models? So far indeed as to give disgust instead of pleasure. The first scene of Iphigenia in Tauris discovers that princess, in a soliloquy, gravely reporting to herself her own history. There is the same impropriety in the first scene of Alcestes, and in the other introductions of Euripides, almost without exception. Nothing can be more ridiculous; it puts one in mind of a most curious device in Gothic paintings, that of making every figure explain itself by a written label issuing from its mouth. The description which a parasite, in the Eunuch of Terence (act ii. sc. 2.) gives of himself, makes a sprightly soliloquy: but it is not consistent with the rules of propriety; for no man, in his ordinary state of mind and upon a familiar subject, ever thinks of talking aloud to himself. The same objection lies against a soliloquy in the Adelphi of the same author (act i. sc. 1.). The soliloquy which makes the third scene, act third of his *Hecyra*, is insufferable; for there Pamphilus, soberly and circumstantially, relates to himself an adventure which had happened to him a moment before.

Corneille is unhappy in his soliloquies: Take for a specimen the first scene of Cinna.

Racine is extremely faulty in the same respect. His soliloquies are regular harangues, a chain completed in every link, without interruption or interval: that of Antiochus in Berenice (act i. sc. 2.) resembles a regular pleading, where the parties *pro* and *con* display their arguments at full length. The following soliloquies are equally faulty: *Bajazet*, act iii. sc. 7.; *Mithridate*, act iii. sc. 4. and act iv. sc. 5.; *Iphigenia*, act iv. sc. 8.

Soliloquies upon lively or interesting subjects, but without any turbulence of passion, may be carried on in a continued chain of thought. If, for example, the nature and sprightliness of the subject prompt a man to speak his thoughts in the form of a dialogue, the expression must be carried on without break or interruption, as in a dialogue between two persons; which justifies Falstaff's soliloquy upon honour:

"What need I be so forward with Death, that calls "not on me? Well, 'tis no matter, Honour pricks me "on. But how, if Honour prick me off, when I come "on? how then? Can honour set a leg? No. Or an "arm? No. Or take away the grief of an wound? "No. Honour hath no skill in surgery then? No. "What is Honour? A word.—What is that word *honour*? Air; a trim reckoning.—Who hath it? He "that dy'd a Wednesday. Doth he feel it? No. "Doth he hear it? No. Is it insensible then? Yea, "to the dead. But will it not live with the living? "No. Why? Detraction will not suffer it. Therefore "I'll none of it; honour is a mere scutcheon: and so "ends my catechism."

First Part, Henry IV. act v. sc. 2.

And even without dialogue a continued discourse may be justified, where a man reasons in a soliloquy upon an important subject: for if in such a case it be at all excusable to think aloud, it is necessary, that the reasoning be carried on in a chain; which justifies that admirable soliloquy in *Hamlet* upon life and immortality, being a serene meditation upon the most interesting of all subjects. And the same consideration will justify the soliloquy that introduces the 5th act of Addison's *Cato*.

Language ought not to be elevated above the tone of the sentiment.

Zara. Swift as occasion I
Myself will fly; and earlier than the morn
Wake thee to freedom. Now 'tis late; and yet
Some news few minutes past arriv'd, which seem'd
To shake the temper of the king——Who knows
What racking cares disease a monarch's bed?
Or love, that late at night still lights his lamp,
And strikes his rays through dusk, and folded lids,
Forbidding rest, may stretch his eyes awake,
And force their balls abroad at this dead hour.
I'll try. *Mourning Bride*, act iii. sc. 4.

The language here is undoubtedly too pompous and laboured for describing so simple a circumstance as absence of sleep. In the following passage, the tone of the language, warm and plaintive, is well suited to the passion, which is recent grief: but every one will be sensible, that in the last couplet save one the tone is changed, and the mind suddenly elevated to be let fall as suddenly in the last couplet:

Il déteste à jamais sa coupable victoire,
Il renounce à la cour, aux humains, à la gloire
Et se fuiant lui-même, au milieu des deserts,
Il va cacher sa peine au bout de l'univers;
Là, soit que le soleil rendit le jour au monde,
Soit qu'il finit sa course au vaste sein de l'onde,
Savoix faisoit redire aux echos attendris,
Le nom, le triste nom, de son malheureux fils.

Henriade, chant. viii. 229.

Light and airy language is unsuitable to a severe passion.

Imagery and figurative expression are discordant, in the highest degree, with the agony of a mother, who is deprived of two hopeful sons by a brutal murder. Therefore the following passage is undoubtedly in a bad taste:

Queen. Ah, my poor princes! ah, my tender babes!
My unblown flowers, new appearing sweets!
If yet your gentle souls fly in the air,
And be not fixt in doom perpetual,
Hover about me with your airy wings,
And hear your mother's lamentation.

Richard III. act iv. sc. 4.

Again:

K. Philip. You are as fond of grief as of your child.
Constance. Grief fills the room up of my absent child,

Lies in his bed, walks up and down with me,
Puts on his pretty looks, repeats his words,
Remembers me of all his gracious parts,
Stuffs out his vacant garment with his form;
Then have I reason to be fond of grief.
K. John, act iii. sc. 9.

Thoughts that turn upon the expression instead of the subject, commonly called *a play of words*, being low and childish, are unworthy of any composition, whether gay or serious, that pretends to any degree of elevation.

In the *Amynta* of Taseo, the lover falls into a mere play of words, demanding how he who had lost himself, could find a mistress. And for the same reason, the following passage in Corneille has been generally condemned:

Chimene. Mon pere est mort, Elvire, et la premiere
épée
Dont s'est armée Rodrigue a sa trame coupée.
Pleurez, pleurez, mes yeux, et fondez-vous en eaux,
La moietié de ma vie a mis l'autre au tombeau,
Et m'oblige à venger, après ce coup funeste,
Celle que je n'ai plus, sur celle que me reste.
Cid, act iii. sc. 3.

To die is to be banish'd from myself:
And Sylvia is myself: banish'd from her,
Is self from self; a deadly banishment!
Two Gentlemen of Verona, act iii. sc. 3.

Countess. I pray thee, Lady, have a better cheer:
If thou engrossest all the griefs as thine,
Thou robb'st me of a moiety.
All's well that ends well, act iii. sc. 3.

K. Henry. O my poor kingdom, sick with civil
blows!
When that my care could not withhold thy riots,
What wilt thou do when riot is thy care?
O, thou wilt be a wilderness again,
Peopled with wolves, thy old inhabitants.
Second Part, Henry IV. act iv. sc. 11.

Cruda Amarilli, che col nome ancora
D'amar, ahi lasso, amaramente insegni.
Pastor Fido, act i. sc. 2.

Antony, speaking of Julius Cæsar:

O world! thou wast the forest of this hart;
And this, indeed, O world, the heart of thee.
How like a deer, stricken by many princes,
Dost thou here lie! *Julius Cæsar*, act iii. sc. 3.

Playing thus with the sound of words, which is still worse than a pun, is the meanest of all conceits. But Shakespeare, when he descends to a play of words is not always in the wrong; for it is done sometimes to denote a peculiar character, as in the following passage:

K. Philip. What say'st thou, boy? look in the lady's
face.
Lewis. I do, my Lord, and in her eye I find
A wonder, or a wond'rous miracle;
The shadow of myself form'd in her eye;
Which being but the shadow of your son,
Becomes a son, and makes your son a shadow.
I do protest, I never lov'd myself
Till now infixed I beheld myself
Drawn in the flatt'ring table of her eye.
Faulconbridge. Drawn in the flatt'ring table of her
eye!
Hang'd in the frowning wrinkle of her brow!
And quarter'd in her heart! he doth espy
Himself Love's traitor: this is pity now,
That hang'd and drawn, and quarter'd there should be,
In such a love so vile a lout as he.
King John, act ii. sc. 5.

A jingle of words is the lowest species of that low wit, which is scarcely sufferable in any case, and least of all in an heroic poem: and yet Milton in some instances has descended to that puerility:

And brought into the world a world of wo.
——Begirth th' Almighty throne
Beseeching or besieging——
Which tempted our attempt——
At one slight bound high overleap'd all bound.
————————With a shout
Loud as from numbers without number.

One should think it unnecessary to enter a caveat against an expression that has no meaning, or no distinct meaning; and yet somewhat of that kind may be found even among good writers.

Sebastian. I beg no pity for this mould'ring clay.
For if you give it burial, there it takes
Possession of your earth:
If burnt and scatter'd in the air; the winds
That strow my dust, diffuse my royalty,
And spread me o'er your clime; for where one atom
Of mine shall light, know there Sebastian reigns.
DRYDEN, *Don Sebastian King of Portugal*, act. i.

Cleopatra. Now, what news, my Charmion?
Will he be kind; and will he not forsake me?
Am I to live or die? nay, do I live?
Or am I dead? for when he gave his answer,
Fate took the word, and then I liv'd or dy'd.
DRYDEN, *All for Love*, act. ii.

If she be coy, and scorn my noble fire,
If her chill heart I cannot move;
Why, I'll enjoy the very love,
And make a mistress of my own desire.
COWLEY, *poem inscribed* "The Request."

His whole poem inscribed *My Picture* is a jargon of the same kind.

——————'Tis he, they cry, by whom
Not men but war itself is overcome.
Indian Queen.

Such empty expressions are finely ridiculed in the *Rehearsal.*

Was't not unjust to ravish hence her breath,
And in life's stead to leave us nought but death?
Act iv. sc. 1.

PASSIONS, in *Medicine*, make one of the non-naturals, and produce very sensible effects. Joy, anger, and fear, are the principal. In the two first, the spirits are hurried with too great vivacity; whereas, in fear or dread, Passion.

dread, they are as it were curbed and concentrated: whence we may conclude, that they have a very bad effect upon health; and therefore it will be best to keep them within bounds as much as possible, and to preserve an inward serenity, calmness, and tranquillity.

PASSIONS, in *Painting*, are the external expressions of the different dispositions and affections of the mind; but particularly their different effects upon the several features of the face: for though the arms, and indeed every part of the body *, serve likewise, by their quick, languid, and variously diversified motions, to express the passions of the soul; yet, in painting, this difference is most conspicuous in the face. See PAINTING, and DRAWING, § 8.

* See *Oratory*, N° 20. 37.

As we have given engravings of Le Brun's drawings of the passions, we shall here subjoin the account which he has given of each of these heads.

Plates CCCCV. and CCCCVI.

1. The effects of *attention* are, to make the eyebrows sink and approach the sides of the nose; to turn the eyeballs toward the object that causes it; to open the mouth, and especially the upper part; to decline the head a little, and fix it without any other remarkable alteration.

2. *Admiration* causes but little agitation in the mind, and therefore alters but very little the parts of the face; nevertheless the eyebrow rises; the eye opens a little more than ordinary; the eyeball placed equally between the eyelids appears fixed on the object; the mouth half opens, and makes no sensible alteration in the cheeks.

3. The motions that accompany *admiration with astonishment* are hardly different from those of simple admiration, only they are more lively and stronger marked; the eyebrows more elevated; the eyes more open; the eyeball further from the lower eyelid, and more steadily fixed: The mouth is more open, and all the parts in a much stronger emotion.

4. Admiration begets esteem, and this produces *veneration*, which, when it has for its object something divine or beyond our comprehension, makes the face decline, and the eyebrows bend down; the eyes are almost shut and fixed: the mouth is shut. These motions are gentle, and produce but little alteration in the other parts.

5. Although *rapture* has the same object as veneration, only considered in a different manner, its motions are not the same; the head inclines to the left side; the eyeballs and eyebrows rise directly up; the mouth half opens, and the two corners are also a little turned up: the other parts remain in their natural state.

6. The passion of *desire* brings the eyebrows close together and forwards toward the eyes, which are more open than ordinary: the eyeball is inflamed, and places itself in the middle of the eye; the nostrils rise up, and are contracted towards the eyes; the mouth half opens, and the spirits being in motion give a lively glowing colour.

7. Very little alteration is remarked in the face of those that feel within themselves the *sweetness of joy*, or *joy with tranquillity*. The forehead is serene; the eyebrow without motion, elevated in the middle; the eye pretty open and with a laughing air; the eyeball lively and shining; the corners of the mouth turn up a little; the complexion is lively; the cheeks and lips are red.

8. *Laughter*, which is produced by joy mixed with surprise, makes the eyebrow rise towards the middle of the eye, and bend towards the sides of the nose; the eyes are almost shut, and sometimes appear wet, or shed tears, which make no alteration in the face; the mouth half open, shows the teeth; the corners of the mouth drawn back, cause a wrinkle in the cheeks, which appear so swelled as to hide the eyes in some measure; the nostrils are open, and all the face is of a red colour.

Passic

9. *Acute pain* makes the eyebrows approach one another, and rise towards the middle; the eyeball is hid under the eyebrows; the nostrils rise and make a wrinkle in the cheeks; the mouth half opens and draws back: all the parts of the face are agitated in proportion to the violence of the pain.

10. *Simple bodily pain* produces proportionally the same motions as the last, but not so strong: The eyebrows do not approach and rise so much; the eyeball appears fixed on some object; the nostrils rise, but the wrinkles in the cheeks are less perceivable; the lips are further asunder towards the middle, and the mouth is half open.

11. The dejection that is produced by *sadness* makes the eyebrows rise towards the middle of the forehead more than towards the cheeks; the eyeball appears full of perturbation; the white of the eye is yellow; the eyelids are drawn down, and a little swelled; all about the eyes is livid; the nostrils are drawn downward; the mouth is half open, and the corners are drawn down; the head carelessly leaning on one of the shoulders: the face is of a lead colour; the lips pale.

12. The alterations that *weeping* occasions are strongly marked: The eyebrows sink down towards the middle of the forehead; the eyes are almost closed, wet, and drawn down towards the cheeks; the nostrils swelled; the muscles and veins of the forehead appear; the mouth is shut, and the sides of it are drawn down, making wrinkles on the cheeks; the under lip pushed out, presses the upper one; all the face is wrinkled and contracted; its colour is red, especially about the eyebrows, the eyes, the nose, and the cheeks.

13. The lively attention to the misfortunes of another, which is called *compassion*, causes the eyebrows to sink towards the middle of the forehead; the eyeball to be fixed upon the object; the sides of the nostrils next the nose to be a little elevated, making wrinkles in the cheeks; the mouth to be open; the upper lip to be lifted up and thrust forwards; the muscles and all the parts of the face sinking down and turning towards the object which excites the passion.

14. The motions of *scorn* are lively and strong: The forehead is wrinkled; the eyebrow is knit; the side of it next the nose sinks down, and the other side rises very much; the eye is very open, and the eyeball is in the middle; the nostrils rise, and draw towards the eyes, and make wrinkles in the cheeks; the mouth shuts, its sides sinking down, and the under-lip is pushed out beyond the upper one.

15. An object despised sometimes causes *horror*, and then the eyebrow knits, and sinks a great deal more. The eyeball, placed at the bottom of the eye, is half covered by the lower eyelid; the mouth is half open, but closer in the middle than the sides, which being drawn

back,

PASSIONS. *PLATE CCCCV.*

TRANQUILLITY.

JOY.

ADMIRATION.

ASTONISHMENT.

ATTENTION & ESTEEM.

SCORN & HATRED.

HORROR.

FRIGHT.

SADNESS.

LAUGHTER.

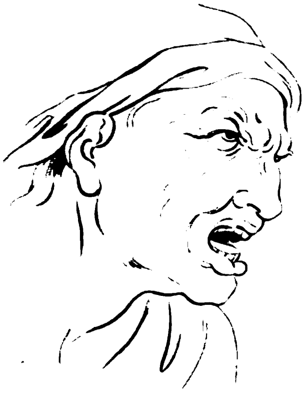
WEEPING.

ANGER.

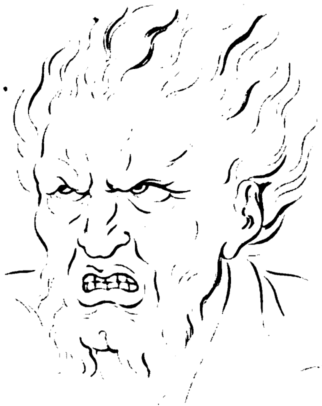
W. Archibald Sculp.t

PASSIONS. *PLATE CCCCVI.*

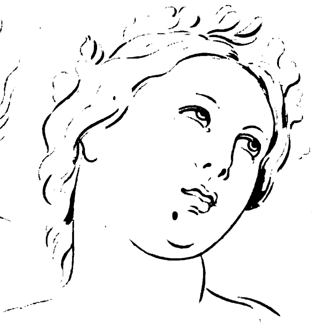
ANGER MIXED with FEAR.



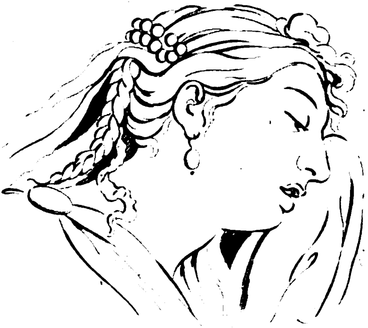
EXTREME DESPAIR.



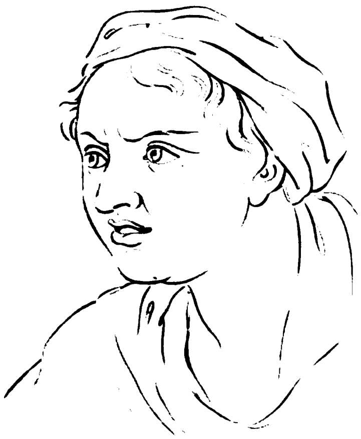
LOVE.



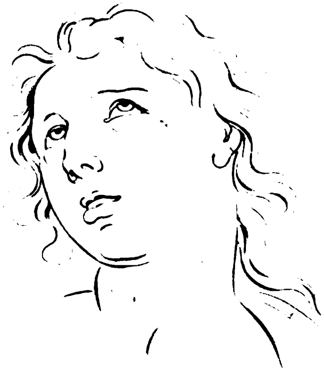
HUMILITY.



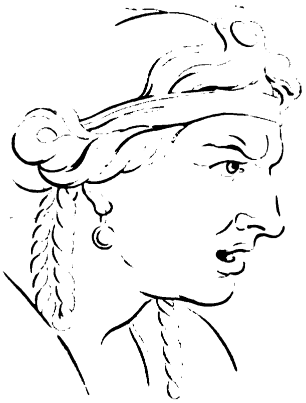
DESIRE.



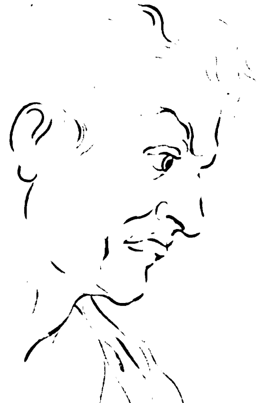
RAPTURE.



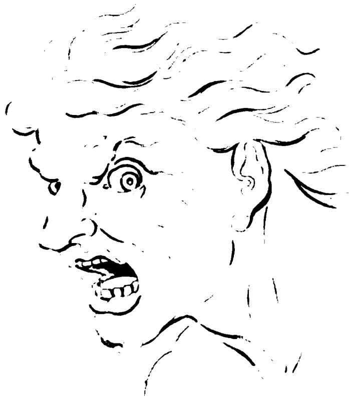
FEAR.



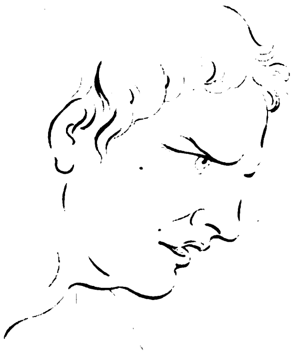
DISDAIN.



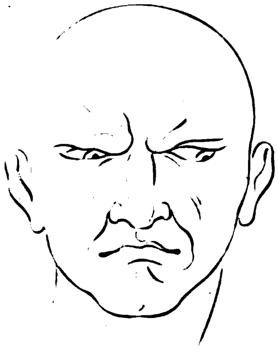
TERROR.



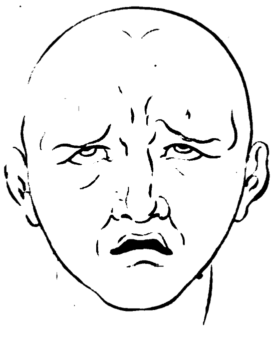
COMPASSION.



JEALOUSY.



ACUTE DISTRESS of BODY & MIND.



W. Archibald Sculp.t

back, makes wrinkles in the cheeks; the face grows pale, and the eyes become livid; the muscles and the veins are marked.

16. The violence of *terror or fright*, alters all the parts of the face; the eyebrow rises in the middle; its muscles are marked, swelled, pressed one against the other, and sunk towards the nose, which draws up as well as the nostrils; the eyes are very open; the upper eyelid is hid under the eyebrow; the white of the eye is encompassed with red; the eyeball fixes toward the lower part of the eye; the lower part of the eyelid swells and becomes livid; the muscles of the nose and cheeks swell, and these last terminate in a point toward the sides of the nostrils; the mouth is very open, and its corners very apparent; the muscles and veins of the neck stretched; the hair stands on end; the colour of the face, that is, the end of the nose, the lips, the ears, and round the eyes, is pale and livid; and all ought to be strongly marked.

17. The effects of *anger* show its nature. The eyes become red and inflamed; the eyeball is staring and sparkling; the eyebrows are sometimes elevated and sometimes sunk down equally: the forehead is very much wrinkled, with wrinkles between the eyes; the nostrils are open and enlarged: the lips pressing against one another, the under one rising over the upper one, leaves the corners of the mouth a little open, making a cruel and disdainful grin.

18. *Hatred and jealousy* wrinkles the forehead; the eyebrows are sunk down and knit; the eyeball is half hid under the eyebrows, which turn towards the object; it should appear full of fire, as well as the white of the eye and the eyelid; the nostrils are pale, open, more marked than ordinary, and drawn backward so as to make wrinkles in the cheeks; the mouth is so shut as to show the teeth are closed; the corners of the mouth are drawn back and very much sunk; the muscles of the jaw appear sunk; the colour of the face is partly inflamed and partly yellowish; the lips pale or livid.

19. As *despair* is extreme, its motions are so likewise; the forehead wrinkles from the top to the bottom; the eyebrows bend down over the eyes, and press one another on the sides of the nose; the eye seems to be on fire, and full of blood; the eyeball is disturbed, hid under the eyebrow, sparkling and unfixed; the eyelid is swelled and livid; the nostrils are large, open, and lifted up; the end of the nose sinks down; the muscles, tendons, and veins, are swelled and stretched; the upper part of the cheeks is large, marked, and narrow towards the jaw; the mouth drawn backwards is more open at the sides than in the middle; the lower lip is large and turned out; they gnash their teeth; they foam; they bite their lips, which are pale; as in the rest of the face; the hair is straight and stands on end.

Passion Flower. See Passiflora, Botany *Index*.

Passion-Week, the week immediately preceding the festival of Easter; so called, because in that week our Saviour's passion and death happened. The Thursday of this week is called *Maunday Thursday;* the Friday, *Good Friday;* and the Saturday, the *Great Sabbath*.

PASSIVE, in general, denotes something that suffers the action of another, called an *agent* or *active power*. In grammar, the verb or word that expresses this passion is termed a *passive verb:* which, in the learned languages, has a peculiar termination; as *amor*, *doceor*, &c. in Latin; that is an *r* is added to the actives, *amo*, *doceo:* and, in the Greek, the inflection is made by changing ω into ομαι; as τυπτω, τυπτομαι, &c. But in the modern languages, the passive inflection is performed by means of auxiliary verbs, joined to the participle of the past tense; as, "I am praised," in Latin *laudor*, and in Greek επαινομαι; or, "I am loved" in Latin *amor*, and in Greek φιλιομαι. Thus it appears that the auxiliary verb *am*, serves to form the passives of English verbs: and the same holds of the French; as, *Je suis loué*, "I am praised;" *j'ai eté loué*, "I have been praised, &c. See Grammar.

Passive Title, in *Scots Law*. See Law, Part III. N° clxxx. 30.

Passive Obedience, a political doctrine which has been much misrepresented, and is, of course, very obnoxious to the friends of freedom. Some nonjurors, in the end of the last and in the beginning of the passing century, imagining that monarchy is the only lawful form of government, and that hereditary monarchy is the only lawful species of that government, have coupled with passive obedience the ridiculous notion of a divine, hereditary, indefeasible right of certain families to govern with despotic sway all other families of the same nation. The absurdity of this notion needs not to be dwelt upon; but it may not be improper, to observe, that it has nothing to do with passive obedience.

As taught by the ablest reasoners, who think that they are supported by the holy scripture, passive obedience is as much a duty under republican as under monarchical governments; and it means no more, but that private individuals are bound by the most solemn moral ties not to resist the supreme power wheresoever placed in any nation. The supreme power can only be the legislature; and no man or body of men, who have not the power of enacting and abrogating laws can, on this principle, claim passive obedience from any subject. Whether the principle be well or ill founded, the absurdity which commonly attaches to the phrase *passive obedience*, originates from the mistaken loyalty of the adherents of the house of Stuart, who to aggravate the illegality of the revolution, were wont to represent James II. as supreme over both houses of parliament, and of course over all law. That such reveries were foolish, we need no farther evidence than the statute-book, which shows, that in the office of legislation, the king, lords, and commons, are co-ordinate; and that when any one of these powers shall take upon itself to counteract the other two, the duty of passive obedience will oblige the subject to support the legislature. That resistance to the legislature, if lawful on any occasion, can be so only to oppose the most violent tyranny, has been shown by Mr Hume with great cogency of argument, and is indeed a proposition self-evident. That it can never be lawful on any occasion, Bishop Berkeley endeavoured to prove by a chain of reasoning which it would be difficult to break. We enter not into the controversy, but refer our readers to Hume's Essays, and Berkeley's Passive Obedience and Nonresistance, or, as it was intitled by a late editor, The Measure of Submission to Civil Government. We shall only observe, that there is a great difference between *active* and *passive* obedience; and that many who consider themselves as bound on *no account* whatever to *resist* the supreme power, would yet *suffer death* rather than do an immoral action in obedience to any law of earthly origin.

Passive Prayer, among the *mystic divines*, is a total suspension or ligature of the intellectual faculties; in virtue whereof, the soul remains of itself, and as to its own power, impotent with regard to the producing of any effects. The passive state, according to Fenelon, is only passive in the same sense as contemplation is, *i. e.* it does not exclude peaceable, disinterested acts, but only unquiet ones, or such as tend to our own interest. In the pasive state, the soul has not properly any activity, and sensation, of its own: it is a mere infinite flexibility of the soul, to which the feeblest impulse of grace gives motion.

PASSOVER, a solemn festival of the Jews, instituted in commemoration of their coming out of Egypt; because the night before their departure, the destroying angel, who put to death the first-born of the Egyptians, passed over the houses of the Hebrews without entering therein, because they were marked with the blood of the lamb which was killed the evening before, and which for this reason was called the *paschal lamb*. This feast was called *pascha* by the old Greeks and Romans; not we presume from πασχω, "I suffer," as Chrysostom, Irenæus, and Tertullian, suppose, but from the Hebrew word *pesah*, *passage*, *leap*. The following is what God ordained concerning the passover of the Jews, (Exod. xii.). The month of the coming forth from Egypt was looked upon from this time to be the first month of the sacred or ecclesiastical year, and the fourteenth day of this month, between the two vespers, that is, between the sun's decline and his setting: or rather, according to our manner of reckoning, between two o'clock in the afternoon and six o'clock in the evening at the equinox, they were to kill the paschal lamb, and to abstain from leavened bread. The day following being the fifteenth, counting from six o'clock of the foregoing evening, which concluded the fourteenth, was the grand feast of the passover, which continued seven days. But it was only the first and the seventh day that were solemn. The lamb that was killed ought to be without any defect, a male, and yeaned that year. If no lamb could be found, they might take a kid. They killed a lamb or a kid in every family; and if the number of those that lived in the house was not sufficient to eat a lamb, they might join two houses together. With the blood of the paschal lamb they sprinkled the door-posts and lintel of every house, that the destroying angel, at the sight of the blood, might pass over them, and save the Hebrew children. They were to eat the lamb the same night that followed the sacrifice; they ate it roasted, with unleavened bread, and a salad of wild lettuce. The Hebrew says literally, with bitter things, as suppose mustard, or any thing of this nature to give a relish. It was forbid to eat any part of it raw, or boiled in water, nor were they to break a bone, (Exod. vii. 46. Numb. ix. 12. John xix. 36.); and if any thing remained to the day following, it was thrown into the fire. They that ate it were to be in the posture of travellers, having their reins girt, their shoes on their feet, their staves in their hands, and eating in a hurry. But this last part of the ceremony was but little observed, at least it was of no obligation, but only upon that night they came forth out of Egypt. For the whole eight days of the passover no leavened bread was to be used; and whoever should eat any, was threatened to be cut off from his people. With regard to the ceremonies which are observed in relation to the bread, see the article BREAD.

They keep the first and last day of the feast, yet so as that it was allowed to dress victuals, which was forbidden on the Sabbath-day. The obligation of keeping the passover was so strict, that whoever should neglect to do it, was condemned to death, (Numb. ix. 13.). But those who had any lawful impediment, as a journey, sickness, or any uncleanness, voluntary or involuntary; for example, those that had been present at a funeral, or by any other accident had been defiled, were to defer the celebration of the passover till the second month of the ecclesiastical year, or to the fourteenth day of the month Jair, which answers to April and May. It was thus the Lord ordered Moses, upon the occasion of the inquiry of some Israelites, who had been obliged to pay their last offices to some of their relations, and who being thus polluted, were not capable of partaking of the paschal sacrifice, (2 Chr. xxx. 1, 2, &c.). The modern Jews observe in general the same ceremonies that were practised by their ancestors, in the celebration of the passover. On the fourteenth of Nisan, the first-born fast in memory of God's smiting the first-born of the Egyptians. The morning prayers are the same with those said on other festivals. They take the roll of the pentateuch out of the chest, and read as far as the end of the twelfth chapter of Exodus, and what is contained in the eighteenth chapter of Numbers, relating to the passover. The matron of the family then spreads a table, and sets on it two unleavened cakes, and two pieces of the lamb, a shoulder boiled and another roasted, to put them in mind that God delivered them with a stretched-out arm. To this they add some small fishes, because of the leviathan; a hard egg, because of the ziz; some meal, because of the behemoth, (these three animals being appointed for the feast of the elect in the other life); and pease and nuts for the children, to provoke their curiosity to ask the reason of this ceremony. They likewise use a kind of mustard, which has the appearance of mortar, to represent their making bricks in Egypt. The father of the family sits down with his children and slaves, because on this day all are free. Being set down, he takes bitter herbs, and dips them in the mustard, then eats them, and distributes to the rest. Then they eat of the lamb, the history and institution of which is at that time recited by the master of the family. The whole repast is attended with hymns and prayers. They pray for the prince under whose dominion they live, according to the advice of Jeremiah (xxix. 7.), "Seek the peace of the city whither I have caused you to be carried away captives, and pray unto the Lord for it: for in the peace thereof shall ye have peace." See the article FEAST, &c. The same things are put in practice the two following days; and the festival is concluded by the ceremony *habdala* or distinction. This ceremony is performed at the closing of the Sabbath-day, at which time the master of the house pronounces certain benedictions, accompanied with certain formalities, requesting that every thing may succeed well the week following. After going out of the synagogue, they then eat leavened bread for the last time. (Leo of Modena, p. iii. c. 3. and the Rabbins). While the temple was standing, they brought their lambs thither, and sacrificed them, offering the blood to the priest, who poured it out at the foot of the altar. The passover was typically predictive of Christ our Christian passover, (1 Cor. v. 7.). As the destroying angel passed over the houses marked with the blood of the paschal lamb, so the wrath of God passes over them whose souls are sprinkled with the blood of Christ. The paschal lamb was killed before Israel was delivered, so it is necessary Christ should suffer before we could be redeemed. It was killed before Moses's law or Aaron's sacrifices were enjoined, to show that deliverance comes to mankind by none of them; but only the true passover, that Lamb of God slain from the foundation of the world, (Rom. iii. 25. Heb. ix. 14.). It was killed the first month of the year, which prefigured that Christ should suffer death in this month, (John xviii. 28.). It was killed in the evening, (Exod. xii. 6.). So Christ suffered in the last days, and at this time of the day, (Matt. xxvii. 46. Heb. i. 2. At even also the sun sets, which shows that it was the Sun of Righteousness who was to suffer and die, and at his passion universal darkness should be upon the whole earth, (Luke xxiii. 44.). The passover was roasted with fire, to denote the sharp and dreadful pains which Christ should suffer, not only from men, but from God also. It was to be eaten with bitter herbs, not only to put them in remembrance of their bitter bondage in Egypt, but also to typify our mortification to sin, and readiness to undergo afflictions for Christ, (Col. i. 24.). Many erroneously imagine, that the passover was instituted in memory of the Israelites passing the Red Sea; though it is certain the feast was held, and had its name, before the Israelites took a step of their way out of Egypt, and consequently several days before their passing the Red Sea. Besides the passover celebrated on the fourteenth of the first month, there was a second passover held on the fourteenth of the second month after the equinox, instituted by God in favour of travellers and sick persons, who could not attend at the first, nor be at Jerusalem on the day. The Greeks, and even some of the catholic doctors, from the thirteenth, eighteenth, and nineteenth, chapters, of St John, take occasion to conclude, that Jesus anticipated the day marked for the passover in the law; but the authority of three evangelists seems to evince the contrary. See Whitby's Dissertation on this subject, in an appendix to the fourteenth chapter of St Mark. F. Lamy supposes, that our Lord did not attend at the passover the last year of his life; which sentiment has drawn upon him abundance of opposers. F. Hardouin asserts, that the Galileans celebrated the passover on one day, and the Jews on another.

PASSPORT, or Pass, a licence or writing obtained from a prince or governor, granting permission and a safe conduct to pass through his territories without molestation: Also a permission granted by any state to navigate in some particular sea, without hinderance or molestation from it. It contains the name of the vessel, and that of the master, together with her tonnage and the number of her crew, certifying that she belongs to the subjects of a particular state, and requiring all persons at peace with that state to suffer her to proceed on her voyage without interruption.

The violation of safe-conducts or passports expressly granted by the king or by his ambassadors to the subjects of a foreign power in time of mutual war, or committing acts of hostility against such as are in amity, league, or truce with us, who are here under a general implied safe-conduct, are breaches of the public faith, without which there can be no intercourse or commerce between one nation and another; and such offences may, according to the writers upon the law of nations, be a proper ground of a national war. And it is enacted by the statute 31 Hen. VI. cap. 4. still in force, that if any of the king's subjects attempt to offend upon the sea, or in any port within the king's obeysance, or against any stranger in amity, league, or truce, or under safe-conduct, and especially by attacking his person, or spoiling him, or robbing him of his goods; the lord-chancellor, with any of the justices of either the king's-bench or common-pleas, may cause full restitution and amends to be made to the party injured. Pasquier says that *passport* was introduced for *passe par-tout*. Balzac mentions a very honourable passport given by an emperor to a philosopher in these terms: "If there be any one on land or sea hardy enough to molest Potamon, let him consider whether he be strong enough to wage war with Cæsar."

Passport is used likewise for a licence granted by a prince for the importing or exporting merchandises, moveables, &c. without paying the duties. Merchants procure such passports for certain kinds of commodities: and they are always given to ambassadors and ministers for their baggage, equipage, &c.

Passport is also a licence obtained for the importing or exporting of merchandises deemed contraband, and declared such by tariffs, &c. as gold, silver, precious stones, ammunition of war, horses, corn, wool, &c. upon paying duties.

PASSUS, among the Romans, a measure of length, being about four feet ten inches, or the thousandth part of a Roman mile. The word properly signifies, the space betwixt the feet of a man walking at an ordinary rate. See Measure.

PASTE, in *Cookery*, a soft composition of flour, wrought up with proper fluids, as water, milk, or the like, to serve for cases or coffins, therein to bake meats, fruits, &c. It is the basis or foundation of pyes, tarts, patties, pasties, and other works of pastry. It is also used in confectionary, &c. for a preparation of some fruit, made by beating the pulp thereof with some fluid or other admixture, into a soft pappy consistence, spreading it into a dish, and drying it with sugar, till it becomes as pliable as an ordinary paste. It is used occasionally also for making the crusts and bottoms of pyes, &c. Thus, with proper admixtures, are made almond pastes, apple pastes, apricot pastes, cherry, currant, lemon, plum, peach, and pear pastes.

Paste is likewise used for a preparation of wheaten flour, boiled up and incorporated with water; used by various artificers, as upholsterers, saddlers, bookbinders, &c. instead of glue or size, to fasten or cement their cloths, leathers, papers, &c. When paste is used by bookbinders, or for paper-hangings to rooms, they mix a fourth, fifth, or sixth, of the weight of the flour of powdered resin; and where it is wanted still more tenacious, gum arabic or any kind of size may be added. Paste may be preserved, by dissolving a little sublimate, in the proportion of a dram to a quart, in the water employed for making it, which will prevent not only rats and mice, but any other kind of vermin and insects, from preying upon it.

PASTES, in the glass trade, or the imitation or counterfeiting of gems in glass; see GEM.

PASTEBOARD, a kind of thick paper, formed of several single sheets pasted one upon another. The chief use of pasteboard is for binding books, making letter-cases, &c. See PAPER.

PASTERN *of a* HORSE, in the manege, is the distance betwixt the joint next the foot and the coronet of the hoof. This part should be short, especially in middle-sized horses; because long pasterns are weak, and cannot so well endure travelling.

PASTERN-Joint, the joint next a horse's foot.

PASTIL, or PASTEL, among painters, a kind of paste made of different colours ground up with gum-water, in order to make CRAYONS.

PASTIL, in *Pharmacy*, is a dry composition of sweet-smelling resins, aromatic woods, &c. sometimes burnt to clear and scent the air of a chamber.

PASTIME, a sport, amusement, or diversion. Pastimes of some kind seem to be absolutely necessary, and to none more than to the man of study; for the most vigorous mind cannot bear to be always bent. Constant application to one pursuit, if it deeply engage the attention, is apt to unhinge the mind, and to generate madness: of which the Don Quixote of Cervantes, and the astronomer of Johnson, are two admirably conceived instances. But though pastime is necessary to relieve the mind, it indicates great frivolity when made the business of life; and yet the rich and the great, who are not obliged to labour for the means of subsistence, too often rove from pastime to pastime with as constant assiduity as the mechanic toils for his family, or as the philosopher devotes himself to the cultivation of science. When those pastimes tend to give elasticity to the mind or strength to the body, such conduct is not only allowable, but praise-worthy; but when they produce effects the reverse of these, it is both hurtful and criminal. The gaming-table, the masquerade, the midnight assembly of any sort, must of necessity enfeeble both the body and the mind; and yet such are the fashionable amusements of the present day, to which many a belle and many a beau sacrifice their beauty, their health, their quiet, and their virtue.

Far different were the pastimes of our wiser ancestors: Remote from vice and effeminacy, they were innocent, manly, and generous exercises. From the ancient records of this country, it appears, that the sports, amusements, pleasures, and recreations, of our ancestors, as described by Fitz-Stephen (A), added strength and agility to the wheels of state mechanism, while they had a direct tendency towards utility. For most of these ancient recreations are resolvable into the public defence of the state against the attacks of a foreign enemy. The play at ball, derived from the Romans, is first introduced by this author as the common exercise of every school-boy. The performance was in a field, where the resort of the most substantial and considerable citizens, to give encouragement and countenance to this feat of agility, was splendid and numerous. The intention of this amusement at this period of time was to make the juvenile race active, nimble, and vigorous; which qualities were requisite whenever their assistance should be wanted in the protection of their country. The next species of pastime indeed does not seem to have this tendency; but it was only, as it seems, an annual custom: This was cock-fighting. The author tells us, that in the afternoon of Shrove-Tuesday, on which day this custom prevailed, they concluded the day in throwing the ball: which seems to insinuate, that the cock-fighting was merely in conformity to ancient usage, and limited only to part of the day, to make way for a more laudable performance. We may reasonably suppose, although this author is entirely silent upon this head, that while cock-fighting was going on, cock-throwing was the sport of the lowest class of people, who could not afford the expence of the former (B). Another species of manly exercise was truly martial, and intended to qualify the adventurers for martial discipline. It is related by Fitz-Stephen thus: "Every Friday in Lent, a company of young men comes into the field on horseback, attended and conducted by the best horsemen: then march forth the sons of the citizens, and other yonng men, with disarmed lances and shields; and there practise feats of war. Many courtiers likewise, when the king is near the spot, and attendants upon noblemen, do repair to these exercises; and while the hope of victory does inflame their minds, they show by good proof how serviceable they would be in martial affairs." This evidently is of Roman descent, and immediately brings to our recollection the *Ludus Trojæ*, supposed to be the invention, as it was the common exercise, of Ascanius. The common people, in this age of masculine manners, made every amusement where strength was exerted the subject-matter of instruction and improvement: instructed

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(A) Otherwise called William Stephanides, a monk of Canterbury, who lived in the reign of King Stephen to the time of Richard I. He wrote a Latin treatise, in which he gives an account of the several pastimes which were countenanced in his time. Bale in his writings draws a pleasing portrait of him. He is likewise sketched in strong and forcible outlines of praise and commendation by Leland Bale says thus of him: "The time which other people usually misemployed in an idle and frivolous manner, he consecrated to inquiries which tended to increase the fame and dignity of his country: in doing which, he was not unworthy of being compared to Plato; for like him, he made the study of men and heaven his constant exercise."

(B) There were places set apart for the battles of these animals, as at this day, where no one was admitted without money. These places, or *pits* commonly called, were schools, as at this day, in which people were instructed in the doctrines of chance, loss and gain, betting and wagers, and particularly in the liberal art of *laying two to one*. Cock-throwing has been laudably abolished; for it was a species of cruelty towards an innocent and useful animal; and such a cruelty as would have kindled compassion in the heart of the rankest barbarian.

instructed to exert their bodily strength in the maintenance of their country's rights; and their minds improved by such exertion, into every manly and generous principle.

In the vacant intervals of industry and labour, commonly called the holy-days, indolence and inactivity, which at this day mark this portion of time, were found only in those whose lives were distempered with age or infirmity. The view which Fitz Stephen gives us of the Easter holydays is animated "In Easter holydays they fight battles upon the water. A shield is hanged upon a pole, fixed in the middle of the stream. A boat is prepared without oars, to be borne along by the violence of the water; and in the forepart thereof standeth a young man, ready to give charge upon the shield with his lance. If so be that he break his lance against the shield, and doth not fall, he is thought to have performed a worthy deed. If without breaking his lance he runs strongly against the shield, down he falleth into the water; for the boat is violently forced with the tide: but on each side of the shield ride two boats, furnished with young men, who recover him who falleth soon as they may. In the holydays all the summer the youths are exercised in leaping, dancing, shooting, wrestling, casting the stone, and practising their shields; and the maidens trip with their timbrels, and dance as long as they can well see. In winter, every holyday before dinner, the boars prepared for brawn are set to fight, or else bulls or bears are baited."

These were the laudable pursuits to which leisure was devoted by our forefathers, so far back as the year 1130. Their immediate successors breathed the same generous spirit. In the year 1222, the sixth year of Henry III. we find, that certain masters in exercises of this kind made a public profession of their instructions and discipline, which they imparted to those who were desirous of attaining excellence and victory in these honourable achievements. About this period, the persons of better rank and family introduced the play of *Tennis* (c); and erected courts or oblong edifices for the performance of the exercise.

About the year 1253, in the 38th year of Henry III. the *Quintan* was a sport much in fashion in almost every part of the kingdom. This contrivance consisted of an upright post firmly fixed in the ground, upon the top of which was a cross piece of wood, moveable upon a spindle; one end of which was broad like the flat part of a halberd, while at the other end was hung a bag of sand. The exercise was performed on horseback. The masterly performance was, when, upon the broad part being struck with a lance, which sometimes broke it, the assailant rode swiftly on, so as to avoid being struck on the back by the bag of sand, which turned round instantly upon the stroke given with a very swift motion. He who executed this feat in the most dexterous manner was declared victor, and the prize to which he became intitled was a peacock. But if, upon the aim taken, the contender miscarried in striking at the broadside, his impotency of skill became the ridicule and contempt of the spectators.

Dr Plott, in his Natural History of Oxfordshire, tells us, that this pastime was in practice in his time at Deddington in this county. "They first (says this author) fixed a post perpendicularly in the ground, and then placed a small piece of timber upon the top of it, fastened on a spindle, with a board nailed to it on one end, and a bag of sand hanging at the other. Against this board they anciently rode with spears: now as I saw it at Deddington only with strong staves, which violently bringing about the bag of sand, if they make not good speed away, it strikes them in the neck or shoulders, and sometimes perhaps strikes them down from their horses; the great design of the sport being to try the agility both of man and horse, and to break the board; which, whoever did, was accounted conqueror: for whom heretofore there was some reward always appointed." (D)

Matthew Paris, speaking of this manly diversion, says, "The London youths made trial of their strength on horseback, by running at the *Quintan*; in doing which, whoever excelled all the rest was rewarded with a peacock." This sport is continued to this day in Wales; and being in use only upon marriages, it may be considered as a votive pastime, by which these heroic spirits seem to wish, that the male issue of such marriage may be as strong, vigorous, and active, as those who are at that time engaged in the celebration of this festive exertion of manhood. Virtuous exercises of this kind would be too rude and barbarous for the attendants on pleasure in the present age. The hand would tremble at the weight of the javelin; and the heart would pant upon the apprehension of personal insecurity. While these exertions of triumphant prowess continued, the sordid degeneracy of disposition, the supple baseness of temper, were unknown: for the love of country, as the Roman orator has wisely observed, *included all other virtues.* But if we guard the palace of honour, like the brazen castle of Danaë, with every possible security, importunate corruption will be ever waiting at the gate, to seize an opportunity of intrusion. These feats of honourable contest were succeeded by the gilded banners of exhibition, and all the long train of dependents' in the interest of indolence: for the writers of these times inform us, that the soft pleasures of the stage forced the passes to public favour in the year 1391, and likewise in the year 1409; so that utility, which before stood on the right hand of pleasure, was now ordered to withdraw for a season. The drama, it seems, was attempted by set of useless and insignificant persons called *parish-clerks;* who, because they had the knowledge of the alphabet, ignorantly presumed that this included every other species of knowledge. The subject was truly serious, the creation of the world; but the performance must have been ludicrous. It was, however, honoured with the attendance of noble personages; and royalty itself deigned to cast a favourable eye upon it, for the king and queen were present. These interludes lasted no longer than the time requisite for the former confederacy of utility and pleasure to resume its powers; as when the pliable bow by being too much bent is put out of shape, and by its elasticity recovers its former position. The lance, the shield, the ball, and the equestrian procession, came forward again, and put the dramatic usurper to flight. After this period, these objects of generous pleasure seem to have had their audience of leave, and one general object, indeed no less manly than the former, to have filled their stations, which was archery. This had a continuance to the reign of Charles I.; for we find in many hospitals founded in that reign, among the articles of benefaction recorded upon their walls, this singular provision, *arms for the boys*, which signified *bows and arrows.*

(c) The word *Tennis* seems to owe its original to the French language: if so, the game is of French production. Yet the word *tenez* will hardly be found to afford incontrovertible evidence upon this subject. For the holding or keeping possession of the ball is no part of the game, but rather a circumstance casually attending it: since, during the performance of it the ball is in continual motion, so there can be no *tenez* at this juncture. Perhaps a place in France called *Tennois* (as there is a town which differs only in a letter, called *Sennois*, in the district of Champagne) was the place where the balls were first made, and the game first introduced.

(D) This was certainly an exercise derived from a military institution of the Romans, though not instrumentally the same. Whoever considers the form and disposition of the Roman camps, which were formed into a square figure, will find there were four principal gates or passages. Near the *Quæstorium*, or Quæstor's apartment, was the *Forum*, or what is now calling a suttling house, and from being near the Quæstor's station called *Quæstorium forum*. At this part was a fifth gate *Quintana*, where the soldiers were instructed in the discipline of the *Polaria*, which was to aim at and strike their javelins against an upright post fixed in the ground, as a kind of *prolusion* to a real engagement with an enemy. By the frequent practice of this exercise, sometimes called *exercitium ad palum* by Roman writers, the soldiers at length acquired not only a dexterity and address in the management of their arms, but a constant and regular exactness in the direction of them. *Titus Livius Patavinus*, cap. 2. *Pancirollus Rerum Memoral.* lib. ii tit. 21. *Vulturius in Augustanis Monumentis*, lib. li. p. 237.

Upon the irruption of the *Istri* into the Roman camps, which they plundered, says Livius, *ad Quæstorium forum, quintanamque pervenerunt.*

There are many places at this day, formerly resorted to, for the practice of this noble art, distinguished by appellations which indicate their ancient usage: such as Brentford Butts, Newington Butts, and many others of the like denomination. It appears from 33 Hen. VIII. that by the intrusion of other pernicious games, archery had been for a long time disused; to revive which this statute was made. It seems that the bows of the best kind were made of yew; and that this wood might be readily obtained for this purpose, yew-trees were planted in church-yards. The sons of those only who were persons of fortune and fashion, if under 17 years of age, were permitted to use such bows. The words of the statute are singular, and ran thus: "No person under seventeen years, except he, or his father or mother, have lands or tenements to the yearly value of ten pounds, or be worth in value or moveables the sum of forty marks sterling, shall shoot with any bow of yew, which shall be bought for him, after the feast of our Lady next coming, under the pain to lose and forfeit six six shillings and eightpence." Two observations arise here upon these words. One, that the yew-wood, not being so common as other wood, might probably be soon found deficient, as it was the best wood for making bows, if not restrained in the use of it to particular ages and persons, as young people wantonly destroy what is put into their hands for useful purposes. The other observation is, that the age of 17 is by this statute distinguished as the age of discretion, when young people are more attentive and considerate in things of private concern; an age in these times which few ever arrive at, and some never. This statute makes provision of other kinds of wood for the common people in the following manner: "To the intent that every person may have bows of mean price, be it enacted, that every bowyer shall, for every bow that he maketh of yew, make four other bows, meet to shoot with, of elm, witch hasill, ash, or other wood apt for the same, under pain to lose and forfeit for every such bow so lacking the sum of three shillings and fourpence." It seems there was a species of yew at this time called *elk*, which wood was stronger and more pliant than the common yew mentioned in this statute, and the price of it fixed. "Moreover, no bowyer shall sell or put to sale to any of the king's subjects, any bow of yew of the tax called *elk*, above the price of three shillings and fourpence, under the pain to forfeit twenty shillings for every bow sold above the said price."

From these several considerations which occur in this statute, we can trace three resplendent qualities, courage, strength, and agility; which three united, inspired to more, generosity and magnanimity. Upon the decline of this and other polished (E) amusements, a savage deformity of manners sprung up, but spangled here and there with the opposite character of lazy opulence, which began now to erect her velvet standard in defiance of chaste and regular manners.

Towards the beginning of James I.'s reign, military prowess seems to have sounded a retreat (F). He, to gratify the importunity of the common people, and at the

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(E) How widely different the conceptions of politeness at this day from what they were in the most refined ages of Greece and Rome! These two states agreed in fixing the standard of this accomplishment upon the fitness and propriety of things. We bend to an arbitrary imposture of language, trusting to the sense and meaning of our opposite Gallic neighbours, as if this island was at all times to be the foot-ball of that continent. To define politeness in its ancient and true sense, it is a manly exertion of conduct, founded upon every noble and virtuous principle. Gallic politeness is an effeminate impotence of demeanor, founded upon fallacy, evasion, and every insidious artifice. There can be no security, no happiness, no prosperity, awaiting this kingdom, so long as we fawn to fashions that disgrace humanity, and to manners which consist of more than Punic perfidy.

(F) It has been confidently asserted by some historians, that James was, during his whole life, struck with terror upon the sight of a drawn sword; which was the reason of his great unwillingness in bestowing the honour of knighthood.

the same time to obviate his own fears upon a refusal, published a book of sports, in which the people had been some time before usually indulged on Sunday evenings, but which had been lately prohibited. These sports consisted of dancing, singing, wrestling, church ales, and other profanations of that day.

Charles, his successor, wisely, in the very entrance of his reign, abolished these sports. The act of Charles states the several amusements in part; by which we may conjecture what was the remainder as stated in the book of sports by James. It is necessary to transcribe that part of the act relating to this subject. "Forasmuch as there is nothing more acceptable to God, than the true and sincere worship of Him, and service according to His holy will, and that the holy keeping of the Lord's day is a principal part of the service of God, which in many places of this realm hath been, and now is, prophaned and neglected by a disorderly sort of people, in exercising and frequenting bear-baiting, bull-baiting, interludes, and common-plays, and other unlawful exercises and pastimes, neglecting divine service both in their own parishes and elsewhere: Be it enacted, that from and after forty days next after the end of this session of parliament, there shall be no meetings, assemblies, or concourse of people, out of their own parishes, on the Lord's day, within this realm of England, or any the dominions thereof, for any sports or pastimes whatsoever: nor any bear-baiting, bull-baiting, interludes, common plays, or other unlawful exercises or pastimes, used by any person or persons within their own parishes: and that every person and persons offending in any of the said premises, shall forfeit for every offence the sum of three shillings and fourpence; the same to be employed and converted to the use of the poor of the parish where such offence shall be committed." All this was perhaps proper, and showed the distinguished piety of this unfortunate monarch. But in this age likewise ended the manly sports of Britons, and nothing was introduced that could compensate for the loss.

All these lusory arts, considered as vehicles of pleasure, from the variety of their inventions, represent pleasure as a fleeting phantom: evincing at the same time the stability of happiness as springing from internal order. Even reflex acts, pregnant with future hopes of solace and social recreation, have more true feelings in expectancy than those which arise from the object in possession. Nay, pleasure is found frequently in the imagination only: for Ixion's disappointment frequently awaits us when we advance to embrace this Juno of our desires.

Upon the whole, happiness, the only thing of intrinsic value, must arise in the heart, and be something more solid than what mere amusement can possibly supply. Amusements or pastimes ought to be considered only as necessary relaxations from severer and more useful employment; and in this point of view they may be solely pursued; but they become criminal when they occupy the place of the business of life.

PASTINACA, the Parsnep, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 45th order, *Umbellatæ*. See Botany *Index*.

PASTOPHORI, among the ancients, were priests whose office it was to carry the images, along with the shrines of the gods, at solemn festivals, when they were to pray to them for rain, fair weather, or the like. The Greeks had a college of this order of priests in Sylla's time. The cells or apartments near the temples, where the pastophori lived, were called *pastophoria*. There were several lodging rooms for the priests of a similar kind in the temple of Jerusalem.

PASTORAL, in general, something that relates to shepherds: hence we say, pastoral life, manners, poetry, &c.

Blair's Lectures, vol. iii. p. 117.

Pastoral life may be considered in three different views; either such as it now actually is; when the state of shepherds is reduced to be a mean, servile, and laborious state; when their employments are become disagreeable, and their ideas gross and low: or such as we may suppose it once to have been, in the more early and simple ages, when it was a life of ease and abundance; when the wealth of men consisted chiefly in flocks and herds, and the shepherd, though unrefined in his manners, was respectable in his state; or lastly, such as it never was, and never can in reality be, when, to the ease, innocence, and simplicity of the early ages, we attempt to add the polished taste and cultivated manners of modern times. Of these three states, the first is too gross and mean, the last too refined and unnatural, to be made the groundwork of pastoral poetry. Either of these extremes is a rock upon which the poet will split, if he approach too near it. We will be disgusted if he give us too much of the servile employments and low ideas of actual peasants, as Theocritus is censured for having sometimes done; and if, like some of the French and Italian writers of pastorals, he make his shepherds discourse as if they were courtiers and scholars, he then retains the name only, but wants the spirit of pastoral poetry.

Pastoral Poetry. See Poetry, Part II. sect. 4.

PASTRY, that branch of cookery which is chiefly taken up in making pies, pasties, cakes, &c. See Paste. Dr Cullen observes, that paste is very hard and indigestible without butter; and even with it, is apt to produce heartburn and acescency. Perhaps this is increased by the burned butter, from a certain sensibility in the stomach, which occasions all empyreumatic oils to be long retained, and so produce acidity.

PASTURE, or *Pasture Land*, is that reserved for feeding cattle. See Agriculture *Index*.

PATÆCI, in *Mythology*, images of gods which the Phœnicians carried on the prows of their gallies. Herodotus, lib. iv. calls them παταικοι. The word is Phœnician, and derived from *pethica*, i. e. *titulus*. See Bocchart's Chanaan, lib. ii. cap. 3. But Scaliger does not agree. Morin derives it from πιθηκος, *monkey*, this animal having been an object of worship among the Egyptians, and hence might have been honoured by their

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knighthood. For at this juncture, he had such a tremor upon him, that instead of laying the sword upon the shoulder of the person to be knighted, he frequently would be observed almost to thrust the point of it into the face of the party: which occasioned those about him to assist him in the direction of his hand.

their neighbours. Mr Elsner has observed, that Herodotus does not call the patæci *gods;* but that they obtained this dignity from the liberality of Hesychius and Suidas, and other ancient lexicographers, who place them at the stern of ships; whereas Herodotus placed them at the prow. Scaliger, Bochart, and Selden, have taken some pains about this subject.—M. Morin has also given us a learned dissertation on this head, in the *Memoires de l' Acad. des Inscript. et Belles Lettres*, tom. i.; but Mr Elsner thinks it defective in point of evidence.

PATAGONIA, a country of South America, comprehending all that country extending from Chili and Paraguay to the utmost extremity of South America; that is, from 35° almost to 54° of latitude: being surrounded by the countries just mentioned, the South and North seas, and the straits of Magellan, which separate it from the island called *Terra del Fuego*, and extend about 116 leagues in length from sea to sea, but only from half a league to three or four in breadth.

This country had the name of *Terra Magellanica*, from Ferdinand Magellan, a Portuguese officer in the service of the Catholic king, who is reported to have sailed through the straits that also bear his name, from the North to the South sea, in the year 1519.

The lofty mountains of the Andes, which are covered with snow a great part of the year, traversing the country from north to south, the air is said to be much colder than in the north under the same parallels of latitude. Towards the north, it is said to be covered with wood, and stored with an inexhaustible fund of large timber; whereas, to the southward, not so much as a single tree fit for any mechanical purpose is to be seen: yet there is good pasture, and incredible numbers of wild horned cattle and horses, which were first brought hither by the Spaniards, and have increased amazingly. Fresh water, we are told by some writers, is very scarce; but if that were really the case, it is difficult to conceive how the present inhabitants and such multitudes of cattle could subsist. The east coast is mostly low land, with few or no good harbours: one of the best is Port St Julian.

Patagonia is inhabited by a variety of Indian tribes; as the Patagons, from which the country takes its name; the Pampas, the Cossares, &c. of whom we know very little. Only it appears, from the accounts of former voyagers, lately confirmed by Commodore Byron and his crew, and the testimonies of other navigators, that some of them are of a gigantic stature, and clothed with skins; but it would seem that there are others who go almost quite naked, notwithstanding the inclemency of the climate. Some of them also, that live about the straits, if we may credit the navigators who have passed that way into the South sea, are perfect savages: but those with whom Commodore Byron and his people conversed, are represented as of a more gentle, humane disposition; only, like other savages, they live on fish and game, and the spontaneous productions of the earth.

The Spaniards once built a fort upon the straits, and left a garrison in it, to prevent any other European nation passing that way into the South sea: but most of the men perished by famine, whence the place obtained the name of *Port Famine;* and no people have attempted to plant colonies here ever since.

About the middle of the strait is a promonto
Cape Froisard, which is the most southerly on
tinent of South America.

On the coasts of Patagonia lie a great nu
islands, or clusters of islands. On the west co
the islands Madre de Dios, Santa Trinidad, Sant
the isles of the Chunians and Huillans, the Sar
and many others; to the number of 80 in all,
say. Of those on the south coast, the most c
able are *Terra del Fuego*, and *Staten Land*. Se
articles.

A vast deal has been said respecting the sta
the Patagonians, by people of different nations,
various occasions. We shall insert the followin
from Mr Charles Clarke, who was on board
ship in 1764, and gave this account to Dr Mat

"We had not got above 10 or 12 leagues in
straits of Magellan, from the Atlantic ocean,
we saw several people, some on horseback, some o
upon the north shore (continent), and with the
our glasses could perceive them beckoning to
come on shore, and at the same time observed t
other, that they seemed to be of an extraordinary
However, we continued to stand on, and should
passed without taking the least farther notice of
could we have proceeded; but our breeze dying
and the tide making against us, we were oblig
anchor; when the commodore ordered his boat
oars, and another of six, to be hoisted out, manne
armed. In the first went the commodore, in the
Mr Cummins our first lieutenant, and myself. A
first leaving the ship, their number did not exceed
but as we approached the shore, we perceived them
ing down from all quarters, some galloping, others
ning, all making use of their utmost expedition.
collected themselves into a body just at the plac
steered off for. When we had got within 12 or 14 y
of the beach, we found it a disagreeable flat shore,
very large stones, which we apprehended would in
the boats; so looked at two or three different plac
find the most convenient for landing. They supp
we deferred coming on shore through apprehensio
danger from them; upon which they all threw open
skins which were over their shoulders, which was
only clothing they had, and consequently the
thing they could secret any kind of arms with,
many of them lay down close to the water's edge.—
commodore made a motion for them to go a little
from the water, that we might have room to la
which they immediately complied with, and withd
30 or 40 yards; we then landed, and formed each n
with his musket, in case any violence should be offer
As soon as we were formed, the commodore went fr
us to them, then at about 20 yards distance: they see
ed vastly happy at his going among them, immediat
gathered round him, and made a rude kind of noi
which I believe was their method of singing; as th
countenances bespoke it a species of jollity. The co
modore then made a motion to them to sit down, whi
they did in a circle, with him in the middle, when
Byron took some beads and ribbons, which he h
brought for that purpose, and tied about the womer
necks, with which they seemed infinitely pleased. W
were struck with the greatest astonishment at the sig
of people of such a gigantic stature, notwithstanding e
previo

previous notice with glasses from the ship. Their body was increased, by the time we got in there, to the number of 500, men, women, and children. The men and women both rode in the same manner; the women had a kind of belt to close their skins round the waist, which the men had not, as theirs were only flung over their shoulders, and tied with two little slips, cut from the skin, round the neck. At the time of the commodore's motion for them to retire farther up the beach, they all dismounted, and turned their horses loose, which were gentle, and stood very quietly. The commodore having disposed of all his presents, and satisfied his curiosity, thought proper to retire; but they were vastly anxious to have him go up into the country to eat with them. That they wanted him to go with them to eat, we could very well understand by their motions, but their language was wholly unintelligible to us.—There was a very great smoke to which they pointed about a mile from us, where there must have been several fires; but some intervening hills prevented our seeing any thing but the smoke. The commodore returned the compliment, by inviting them on board the ship; but they would not favour him with their company; so we embarked, and returned to the ship. We were with them near two hours at noon-day within a very few yards, though none had the honour of shaking hands but Mr Byron and Mr Cummins; however, we were near enough, and long enough with them, to convince our senses, so far as not to be cavilled out of the very existence of those senses at that time, which some of our countrymen and friends would absolutely attempt to do. They are of a copper colour, with long black hair; and some of them are certainly nine feet, if they do not exceed it. The commodore, who is very near six feet, could but just reach the top of one of their heads, which he attempted on tip-toes, and there were several taller than the person on whom the experiment was tried. They are prodigious stout, and as well and as proportionally made as ever I saw people in my life. That they have some kind of arms among them, is, I think, indisputable, from their taking methods to convince us they had none at that time about them. The women, I think, bear much the same proportion to the men as our Europeans do; there was hardly a man there less than eight feet, most of them considerably more. The women, I believe, run from seven and a half to eight feet.—Their horses were stout and bony, but not remarkably tall; they are, in my opinion, from 15 to 15½ hands. They had a great number of dogs, about the size of a middling pointer, with a fox nose. They continued on the beach till we got under way, which was two hours after we got on board. I believe they had some expectations of our returning again; but as soon as they saw us getting off, they betook themselves to the country.

"The country of Patagonia is rather hilly, though not remarkably so. You have here and there a ridge of hills, but no very high ones. We lay some time at Port Desire, which is not a great way to the northward of the straits, where we traversed the country many miles round. We found fire-brands in different places, which convinced us there had been people, and we suppose them to have been the Patagonians. The soil is sandy, produces nothing but a coarse harsh grass, and a few small shrubs, of which Sir John Narborough remarked, he could not find one of size enough to make the helve of a hatchet; which observation we found very just. It was some time in the winter we made this visit to our gigantic friends. I am debarred being so particular as I could wish, from the loss of my journals, which were demanded by their lordships of the admiralty immediately upon our return."

That the whole of this account is true, we cannot assert; but that the writer has been misled in some respects, and misinformed with regard to some of his facts, is at least probable: for Captain Wallis, who went out to the straits of Magellan after Byron's return, gives a different turn to many of the observations; and with respect to the stature of the people, he differs very materially. We shall give the following epitome of his remarks on what occurred to him.—He had three ships with him, which entered the straits on the 16th December 1766, and came to an anchor in a bay south of Cape Virgin Mary, where they were immediately accosted by a whole troop of Patagonians, who made signs for them to come on shore. The captain, having made previous dispositions for the security of his men in case of an attack, manned all the boats belonging to the three ships, and with a party of marines landed on the beach where those giants had assembled. The commanders of the three ships, and most of their officers, were of this party. On their leaping ashore, the Indians seemed to welcome them; and being by signs desired to retreat, they all fell back, and made room for the marines to form. When they were drawn up, Captain Wallis advanced, and by signs directed the Indians to seat themselves in a semicircle, which they readily understood and obeyed. He then distributed among them knives, scissars, buttons, beads, combs, and particularly ribbons, with which he complimented the women, who received them with a mixture of pleasure and respect. He then gave them to understand that he had still more valuable articles to bestow, and showed them axes and bill-hooks; but, at the same time, pointed to some guanicoes and ostriches, intimating that he expected some of those in return: but they either did not, or would not, understand him; so that no traffic took place.

The whole company that were assembled on this occasion, had each a horse with a saddle and bridle. The saddle had a sort of stirrups, and the bridle was made of thongs of leather very well put together, for the purpose of guiding the horses. The women, as well as the men, rode astride. The men, in general, wore each a wooden spur: but one of them had a large pair of Spanish spurs, brass stirrups, and a Spanish scimitar. Their horses were nimble and spirited, but small in proportion to their riders, seemingly not above 14 hands high. Their dogs were of the Spanish breed. The captain, having purposely provided himself with measuring rods, found that the tallest man among them measured only six feet seven inches high; several were within an inch or two as tall: but the ordinary size was from five feet ten inches to six feet. It is pity that none of our voyagers thought of measuring the whole size of one of those gigantic men. They tell us, indeed, that they are well made, that they are proportionally large, and that they are robust and bony; but they give us no criterion to judge of their bulk, nor one instance of their extraordinary strength. As they are represented not only peaceable, Patagonia.

peaceable, but remarkably tractable, some trials might have been made of the weight they could have lifted, and how much they could exceed in that respect the strongest man in the ships. This, in a great measure, would have determined the point, which is yet left doubtful by the different relations that are given by the different voyagers who have seen these people, no two of them agreeing in the same description. All agree, however, that their hair is black, and harsh like bristles; that they are of a dark copper colour, and that their features are rather handsome than ugly; that they clothe themselves decently with the skins of guanicoes; that they paint themselves variously; and there is reason to suspect, that by that variety they distinguish their tribes. Those seen by Commodore Byron were painted round both eyes, no two of them alike; those seen by Captain Wallis had only a red circle round the left eye; and those seen by Bougainville had no circle round the eyes, but had their cheeks painted red. This may account for the different reports of voyagers concerning their stature: it is not impossible, nay, it is very probable, that they may vary in this particular, according to their tribes; as is seen in the Highlands of Scotland, where one clan of the Campbells is remarkably tall, and another of the Frasers remarkably short. Were it not for some such natural discrimination, there could not be so wide a difference in the descriptions of gentlemen, who, having no ends to serve, either in falsifying one another's reports, or in imposing upon the public, cannot be supposed to mistake wilfully.

One remarkable observation made by our voyagers must not be omitted; and that is, that though our people could distinguish but one word of their language, which the English pronounce *chewow*, and the French *shawa*, yet the Patagonians could repeat whole sentences after our men more distinctly than almost any European foreigner of what nation soever. This appears the more singular, as, among the islanders between the tropics, it was hardly possible to make them articulate any of our words. Sydney Parkinson, in a specimen he has given us, says, that though the English remained at Otaheite three months, the nearest the natives could approach the sound of *Cook* was *Toote; Banks*, *Opane; Solander*, *Tolano; Gore*, *Towara; Monkhouse*, *Mata;* and so of the rest: whereas the Patagonians presently got by heart this sentence of invitation, *Come ashore, Englishmen!* which they showed they well understood, by repeating it afterwards whenever the ships came so near the shore as to be within call.

Another very remarkable particular is, that they had none of the characters of a ferocious people; there was no offensive weapon among them, except the scimitar already mentioned. The men, indeed, had a kind of sling, which they use in hunting, consisting of two round stones of about a pound weight each, connected together by a thong. These stones were fastened to the extremities of the thong; and, when they threw them, they held one stone in the hand, and swung the other about the head. "They are so expert in the management of this double-headed shot (says the writer of the voyage), that they will hit a mark not bigger than a shilling with both these stones at the distance of fifteen yards; but their method of availing themselves of their dexterity against the guanicoe and ostrich is, to sling the stones
so as to entangle their legs, by which means they
tarded in their flight, and easily overtaken. I
ville speaks of these slings as common among o
dian nations in South America; but we do not
ber to have seen this assertion confirmed by a
voyager.

These people certainly dress differently as
paint differently; for the dress described by B
ville is very unlike the dress of those seen by th
lish voyagers. Captain Wallis invited some c
on board his ship: but, among all the wonde
were shown them, none seemed to attract their
so much as the looking-glasses: they looked
glasses and at each other; they laughed and
and gazed again and laughed; in short, there
end to their merriment when in possession of this
of curiosity. They ate whatever was given the
would drink nothing but water. In this they
from all the tribes of Indians in North Americ
are immoderately fond of spirituous liquors.
admired the European sheep, hogs, and poultry
did not seem over-desirous of any thing they sa
cept clothes. When the marines were exercised
tertain them, they appeared disconcerted; an ol
among them made signs, by striking his breast
tumbling down and lying as if he had been dead
deck, that he knew the effect of their guns; and
of them seemed easy till the firing was over.
the captain had satisfied his own curiosity, and,
imagined, theirs, he gave them to understand, th
was going to sail, and that they must depart;
they were very unwilling to do. However, h
given each of them a canvas bag, with some ne
ready threaded, a knife, a pair of scissars, a few b
a comb, and a looking-glass, he dismissed them,
great reluctance on their part, particularly on th
the old man's, who by very significant signs expr
his desire to stay till sunset.

PATAGONULA, in *Botany*, a genus of plant
longing to the pentandria class. See BOTANY *In*

PATAN, a kingdom of Asia, in the East In
and in the peninsula of Malacca, and on the eas
coast between the kingdoms of Siam and Paha.
inhabitants are partly Mahometans and partly Gent
but they are all very voluptuous. The air is wholes
though very hot; and they have no seasons but
winter and summer. The former is more properly
rainy season; and contains the months of Novem
December, and January. The woods are full of
phants and many wild animals. Some voyagers
tend that this country is governed by a queen, who ne
marries, but may have as many gallants as she plea
They have some trade with the Chinese; and the pr
cipal town is of the same name, which is one of
strongest in these parts, having a well defended harbo

PATAN, a town of Hindoostan, in the valley of N
paul, about a mile and a half from Katmandoo, the
pital. E. Long. 85. 40. N. Lat. 27. 30.

PATAVINITY, among critics, denotes a pecu
arity of Livy's diction; derived from Patavium or P
dua, the place of his nativity; but wherein this pat
vinity consists, they are by no means agreed.

Asinius Pollio, according to Quintilian, taxed Li
with patavinity. But what he meant by this censu

we believe no man can say. Morhof believes it to be a singular turn of expression, and some phrases peculiar to the Paduese. All we certainly know about it is, that it was a fault in the language of Livy, not in the sentiments or manners. In all probability, it is one of those delicacies that are lost in a dead language. Dan. Georg. Morhof published a treatise *De Patavinitate Liviana*, at Kiel, in 1685, where he explains, very learnedly, the urbanity and peregrinity of the Latin tongue.

PATARA, (Livy, Mela); the capital of Lycia, to the east of the mouth of the river Xanthus; famous for a temple and oracle of Apollo, thence called *Patareus*, three syllables only; but *Pataræus*, (Horace). For the six winter months, Apollo gave answers at Patara; and for the six summer at Delos, (Virgil, Servius): these are the *Lyciæ Sortes* of Virgil. The town was situated in a peninsula, called *Liciorum Chersonesus*, (Stephanus), Acts xxi. 1. St Paul in his passage from Philippi to Jerusalem, came to Miletus, hence to Coos, then to Rhodes, and from Rhodes to Patara; where having found a ship that was bound for Phœnicia, he went on board and arrived at Jerusualem, to be at the feast of Pentecost.

PATAVIUM (Tacitus, Strabo), a town of the Transpadana, situated on the left or north bank of the Medoacus Minor; founded by Antenor the Trojan, (Mela, Virgil, Seneca); *Patavini*, the people, (Livy); who himself was a native, and by Asinius Pollio charged with patavinity. Now *Padua* in the territory and to the west of Venice. E. Long. 12. 15. N. Lat. 45. 30

PATAY, a town of France, in the province of Orleannois, remarkable for the defeat of the English in 1429, and where Joan of Arc did wonders. E. Long. 1. 43. N. Lat. 48. 5.

PATE, in *Fortification*, a kind of platform, resembling what is called an *horse's shoe*.

PATEE, or PATTEE, in *Heraldry*, a cross, small in the centre, and widening to the extremities, which are very broad.

PATELLA, or KNEE-PAN, in *Anatomy*. See ANATOMY *Index*.

PATELLA, or LIMPET, a genus of shell-fish belonging to the order of vermes testacea. See CONCHOLOGY *Index*.

PATELLA, in the History of Insects, a name given by Lister and other authors to a little husk or shell, found on the bark of the cherry, plum, rose, and other trees, containing an animal within, and useful in colouring. These patellæ are of the form of globes, except where they adhere to the tree, and are for the most part of a shining chesnut colour. The husk itself strikes a very fine crimson colour on paper, and within it is found a white maggot which is of no value: this, in time, hatches into a very small but beautiful bee. The size of this bee is about half that of an ant. They have a sting like bees, and three spots placed in a triangle on the forehead, which are supposed to be eyes. They are of a black colour, and have a large round whitish or pale yellow spot on the back. The upper pair of wings are shaded and spotted, but the under pair are clear. It might be worth while to try the shells or husks in order to discover whether the colour they yield might not be useful. It is to be remarked, that the deepest coloured husks afford the finest and deepest purple: they must be used while the animal in them is in the maggot form; for when it is changed into the bee state the shell is dry and colourless. Lister, who first observed these patellæ, went so far, on comparing them with the common kermes, as to assert that they were of the same nature with that production: but his account of their being the workmanship of a bee, to preserve her young maggot in, is not agreeable to the true history of the kermes; for that is an insect of a very peculiar kind. He has in other instances been too justly censured for his precipitancy of judging of things, and perhaps has fallen into an error by means of it here. It is very possible that these patellæ may be the same sort of animals with the kermes, but then it produces its young within the shell or husk, which is no other than the skin of the body of the mother animal; but as there are many flies whose worms or maggots are lodged in the bodies of other animals, it may be that this little bee may love to lay its egg in the body of the proper insect, and the maggot hatched from that egg may eat up the proper progeny, and, undergoing its own natural changes there, issue out at length in form of the bee. This may have been the case in some few which Dr Lister examined; and he may have been misled by this to suppose it the natural change of the insect.

PATENT, in general, denotes something that stands open or expanded: thus a leaf is said to be patent, when it stands almost at right angles with the stalk.

PATENT, or *Letters Patent*. See LETTER.

PATER NOSTER, the *Lord's Prayer*, so called from the two first words thereof in Latin.

PATER Noster, islands of Asia, in the East Indian sea, so called because of the great number of rocks, which sailors have likened to the beads with which the Papists tell their pater-noster. They abound in corn and fruits, and are very populous.

PATER Patratus, was the name of the first and principal person in the college of heralds called *Feciales*. Some say the Pater Patratus was a constant officer and perpetual chief of that body; and others suppose him to have been a temporary minister, elected upon account of making peace or denouncing war, which were both done by him. See FECIALES.

PATERA, among antiquaries, a goblet or vessel used by the Romans in their sacrifices; wherein they offered their consecrated meats to the gods, and wherewith they made libations. See SACRIFICE and LIBATION.

The word is Latin, formed from *pateo*, "I am open;" *quod pateat*, "because it has a great aperture;" in contradistinction to bottles, &c. which have only narrow necks, or whose aperture is less than the body of the vessel.

On medals the patera is seen in the hands of several deities; and frequently in the hands of princes, to mark the sacerdotal authority joined with the imperial, &c.

Hence F. Joubert observes, that besides the patera, there is frequently an altar upon which the patera seems to be pouring its contents.

The patera was of gold, silver, marble, brass, glass, or earth; and they used to inclose it in urns with the ashes of the deceased, after it had served for the libations of the wine and liquors at the funeral.

The patera is an ornament in architecture, frequently seen in the Doric frieze, and the tympans of arches; and they are sometimes used by themselves, to ornament a space; and in this case it is common to hang a string of husks or drapery over them: sometimes they are much enriched with foliage, and have a mask or a head in the centre.

PATERCULUS, Caius Velleius, an ancient Roman historian, who flourished in the reign of Tiberius Cæsar, was born in the year of Rome 735. His ancestors were illustrious for their merit and their offices. His grandfather espoused the party of Tiberius Nero, the emperor's father; but being old and infirm, and not able to accompany Nero when he retired from Naples, he ran himself through with his sword. His father was a soldier of rank, and so was Paterculus himself. He was a military tribune when Caius Cæsar, a grandson of Augustus, had an interview with the king of the Parthians, in an island of the river Euphrates, in the year 753. He commanded the cavalry in Germany under Tiberius; and accompanied that prince for nine years successively in all his expeditions. He received honourable rewards from him; but we do not find that he was preferred to any higher dignity than the prætorship. The praises he bestows upon Sejanus give some probability to the conjecture, that he was looked upon as a friend of this favourite, and consequently that he was involved in his ruin. His death is placed by Mr Dodwell in the year of Rome 784, when he was in his 50th year.

He wrote an abridgement of the Roman History in two books, which is very curious. His purpose was only to deduce things from the foundation of Rome to the time wherein he lived; but he began his work with things previous to that memorable era; for, though the beginning of his first book is wanting, we yet find in what remains of it, an account of many cities more ancient than Rome. He promised a larger history; and no doubt would have executed it well: for during his military expeditions he had seen, as he tells us, the provinces of Thrace, Macedonia, Achaia, Asia Minor, and other more easterly regions; especially upon the shores of the Euxine sea, which had furnished his mind with much entertaining and useful knowledge. In the Abridgement which we have, many particulars are related that are nowhere else to be found; and this makes it the more valuable. The style of Paterculus, though miserably disguised through the carelessness of transcribers, and impossible to be restored to purity for want of manuscripts, is yet manifestly worthy of his age, which was the time of pure Latinity. The greatest excellence of this historian lies in his manner of commending and blaming those he speaks of; which he does in the finest terms and most delicate expressions. He is, however, condemned, and indeed with the greatest reason, for his partiality to the house of Augustus; and for making the most extravagant eulogies, not only upon Tiberius, but even upon his favourite *Sejanus:* whom, though a vile and cruel monster, Paterculus celebrates as one of the most excellent persons the Roman commonwealth had produced. Lipsius, though he praises him in other respects, yet censures him most severely for his insincerity and partiality. "Velleius Paterculus (says he) raises my indignation: he represents Sejanus as endowed with all good qualities. The impudence of this historian! But we know that he was born, and died, to the destruction of mankind. After many commendations, he concludes, that Liva was a woman more resembling the gods than men: and as to Tiberius, he thinks it a crime to speak otherwise of him than as of an immortal Jove. What sincere and honest mind can bear this? On the other hand, how artfully does he everywhere conceal the great qualities of Cæsar Germanicus! how obliquely does he ruin the reputation of Agrippina and others, whom Tiberius was thought to hate! In short, he is nothing but a court-prostitute. You will say, perhaps, it was unsafe to speak the truth as those times: I grant it; but if he could not write the truth, he ought not to have written lies: none are called to account for silence." La Mothe le Vayar has made a very just remark upon this occasion: "The same fault (says he) may be observed in many others, who have written the history of their own times, with a design to be published while they lived."

It is strange, that a work so elegant and worthy to be preserved, and of which, by reason of its shortness, copies might be so easily taken, should have been so near being lost. One manuscript only has had the luck to be found, as well of this author among the Latins as of Hesychius among the Greeks: in which, says a great critic of our own nation, "The faults of the scribes are found so numerous, and the defects so beyond all redress, that notwithstanding the pains of the learned and most acute critics for two whole centuries, these books still are, and are like to continue, a mere heap of errors." No ancient author but Priscian makes mention of Paterculus: the moderns have done him infinitely more justice, and have illustrated him with notes and commentaries. He was first published from the manuscript of Morhac, by Rhenanus, at Basil in 1520: afterwards by Lipsius at Leyden in 1581; then by Gerard Vossius in 1639; next by Boeclerus at Strasburg in 1642; then by Thysius and others; and, lastly, by Peter Burman at Leyden, 1719, in 8vo. To the Oxford edition in 1693, 8vo, were prefixed the *Annales Velleiani* of Mr Dodwell, which show deep learning and a great knowledge of antiquity.

PATH, in general, denotes the course or track marked out or run over by a body in motion.

For the path of the moon, &c. see Moon, &c. Astronomy *Index*.

PATHETIC, whatever relates to the passions, or that is proper to excite or awake them. The word comes from the Greek *παθος*, *passion* or *emotion*. See Passion.

Pathetic, in *Music*, something very moving, expressive, or passionate; capable of exciting pity, compassion, anger, or other passions. Thus we speak of the pathetic style, a pathetic figure, pathetic song, &c. The chromatic genus, with its greater and lesser semitones, either ascending or descending, is very proper for the pathetic; as is also an artful management of discords; with a variety of motions, now brisk, now languishing, now swift, now slow.

Nieuwentyt speaks of a musician at Venice who so excelled in the pathetic, that he was able to play any of his auditors into distraction: he says also, that the great means he made use of was the variety of motions, &c.

PATHOGNOMONIC, among *Physicians*, an appellation for a symptom, or concourse of symptoms, that are inseparable from a distemper, and are found in that only, and in no other.

PATHOLOGY, that part of medicine which explains the nature of diseases, their causes and symptoms. See MEDICINE.

PATHOS, a Greek term, literally signifying passion.

PATHROS, a city and canton of Egypt, of which the prophets Jeremiah and Ezekiel make mention; Jerem. xliv. 1. 15. Ezek. xxix. 14. xxx. 14. We do not very well know its situation, though Pliny and Ptolemy the geographer speak of it by the name of Phaturis; and it appears to have been in Upper Egypt. Isaiah (xii. 2.) calls it Pathros; and it is the country of the Pathrusim, the posterity of Mizraim, of whom Moses speaks, Gen. x. 14. Ezekiel threatens them with an entire ruin. The Jews retired thither notwithstanding the remonstrances of Jeremiah; and the Lord says by Isaiah, that he will bring them back from thence.

PATIENCE, that calm and unruffled temper with which a good man bears the evils of life, from a conviction that they are at least permitted, if not sent, by the best of Beings, who makes all things work together for good to those who love and fear him.

The evils by which life is embittered may be reduced to these four: 1. Natural evils, or those to which we are by nature subject as men, and as perishable animals. The greatest of these are, the death of those whom we love, and of ourselves. 2. Those from which we might be exempted by a virtuous and prudent conduct, but which are the inseparable consequences of imprudence or vice, which we shall call punishments; as infamy proceeding from fraud, poverty from prodigality, debility and disease from intemperance. 3. Those by which the fortitude of the good are exercised; such as the persecutions raised against them by the wicked. To these may be added, 4. The opposition against which we must perpetually struggle, arising from the diversity of sentiments, manners, and characters of the persons among whom we live.

Under all these evils patience is not only necessary but useful: it is necessary, because the laws of nature have made it a duty, and to murmur against natural events is to affront providence; it is useful, because it renders our sufferings lighter, shorter, and less dangerous.

Is your reputation sullied by invidious calumnies? rejoice that your character cannot suffer but by false imputations. You are arraigned in a court of judicature, and are unjustly condemned: passion has influenced both your prosecutor and your judge, and you cannot forbear repining that you suffer although innocent. But would it have been better that you should have suffered being guilty? Would the greatest misfortune that can befal a virtuous man be to you a consolation? The opulence of a villain, the elevated station to which he is raised, and the honours that are paid to him, excite your jealousy, and fill your bosom with repinings and regret. What! say you, are riches, dignity, and power, reserved for such wretches as this? Cease these groundless murmurs. If the possessions you regret were real benefits, they would be taken from the wicked and transferred to you. What would you say of a successful hero, who, having delivered his country, should complain that his services were ill requited, because a few sugar-plums were distributed to some children in his presence, of which they had not offered him a share? Ridiculous as this would appear, your complaints are no better founded. Has the Lord of all no reward to confer on you but perishable riches and empty precarious honour?

It is fancy, not the reason of things, that makes life so uneasy to us. It is not the place nor the condition, but the mind alone, that can make anybody happy or miserable.

He that values himself on conscience, not opinion, never heeds reproaches. When we are evil spoken of, if we have not deserved it, we are never the worse; if we have, we should mend.

Tiberius the Roman emperor, at the beginning of his reign, acted in most things like a truly generous, good natured, and clement prince. All slanderous reports, libels, and lampoons upon him and his administration, he bore with extraordinary patience; saying, "That in a free state the thoughts and tongues of every man ought to be free;" and when the senate would have proceeded against some who had published libels against him, he would not consent to it; saying, "We have not time enough to attend to such trifles; if you once open a door to such informations, you will be able to do nothing else; for under that pretence every man will revenge himself upon his enemies by accusing them to you." Being informed that one had spoken detractingly of him: "If he speak ill of me," says he, "I will give him as good an account of my words and actions as I can; and if that be not sufficient, I will satisfy myself with having as bad an opinion of him as he has of me." Thus far even Tiberius may be an example to others.

Men will have the same veneration for a person who suffers adversity without dejection, as for demolished temples, the very ruins of which are reverenced and adored.

A virtuous and well-disposed person, is like to good metal; the more he is fired, the more he is refined; the more he is opposed, the more he is approved; wrongs may well try him and touch him, but cannot imprint in him any false stamp.

The man therefore who possesses this virtue (patience), in this ample sense of it, stands upon an eminence, and sees human things below him: the tempest indeed may reach him; but he stands secure and collected against it upon the basis of conscious virtue, which the severest storms can seldom shake, and never overthrow.

Patience, however, is by no means incompatible with sensibility, which, with all its inconveniences, is to be cherished by those who understand and wish to maintain the dignity of their nature. To feel for others, disposes us to exercise the amiable virtue of charity, which our religion indispensably requires. It constitutes that enlarged benevolence which philosophy inculcates, and which is indeed comprehended in Christian charity. It is the privilege and the ornament of man; and the pain which it causes is abundantly recompensed by that sweet sensation which ever accompanies the exercise of beneficence.

To feel our own misery with full force is not to be deprecated. Affliction softens and improves the heart. Tears, to speak in the style of figure, fertilize the soil in which the virtues grow. And it is the remark of one who understood human nature, that the faculties of the mind, as well as the feelings of the heart, are meliorated by adversity.

But in order to promote these ends, our sufferings must not be permitted to overwhelm us. We must oppose them with the arms of reason and religion; and to express the idea in the language of the philosopher, as well as the poet, of Nature, every one, while he is compelled to feel his misfortunes like a man, should resolve also to bear them like a man.

Resign'd in ev'ry state,
With patience bear, with prudence push, your fate;
By suffering well our fortune, we subdue,
Fly when she frowns, and when she calls pursue.

PATIGUMO (a corruption of the words *pate-de guimauve*); the name of a sort of paste or cakes much used on the continent as an agreeable and useful remedy for catarrhal defluxions, and supposed by Dr Percival to consist of gum-arabic combined with sugar and the whites of eggs (see the article HUNGER). But we have been informed that the powdered substance of the marshmallow is the chief ingredient of the composition.

PATIN, GUY, professor of physic in the royal college of Paris, was born in 1602. He made his way into the world merely by the force of his genius, being at first corrector of a printing-house. He was a man of great wit and erudition: he spoke with the gravity of a Stoic, but his expressions were very satirical. He hated bigotry, superstition, and knavery; had an upright soul, and a well-disposed heart. He was a most tender father, courteous to every body, and polite in the highest degree. He died in 1672, and did not owe his reputation to any writings published in his lifetime upon physic; but his letters which appeared after his death have rendered his name famous. He left a son mentioned in the ensuing article.

PATIN, *Charles*, who made a great figure in the world, and excelled in the knowledge of medals. He was born in Paris in 1633; and made so surprising a progress, that he maintained theses in Greek and Latin on all parts of philosophy, in 1647. He studied the law in compliance to an uncle, and was admitted an advocate in the parliament of Paris; but could not lay aside that of physic, for which he always had an inclination. He therefore quitted the law, and devoted himself to physic; in which, after taking the doctor's degree, he applied himself to practice with great success. He afterwards travelled into Germany, Holland, England, Switzerland, and Italy. In 1676, he was appointed professor of physic in Padua; and three years after was created a knight of St Mark. He died in that city in 1694. His works are many, and well known to the learned world. His wife too, and his daughters were authoresses.

PATKUL, JOHN REINHOLD, was born of a noble family in Livonia, a northern province belonging to the crown of Sweden. The Livonians having been stript of their privileges, and great part of their estates, by Charles XI. Patkul was deputed to make their complaint; which he did with such eloquence and courage, that the king, laying his hand upon his shoulder, said, 'You have spoken for your country as a brave man should, and I esteem you for it.'

Charles, however, who added the baseness of hypocrisy to the ferocity of a tyrant, was determined to punish the zeal and honesty which he thought fit to commend; and a few days afterwards caused Patkul to be declared guilty of high treason, and condemned to die. Patkul, however, found means to escape into Poland, where he continued till Charles was dead. He hoped that his sentence would have been then reversed, as it had been declared unjust even by the tyrant that procured it: but being disappointed in this expectation, he applied to Augustus king of Poland, and solicited him to attempt the conquest of Livonia from the Swedes; which, he said, might be easily effected, as the people were ready to shake off their yoke, and the king of Sweden was a child incapable of compelling their subjection.

Augustus possessed himself of Livonia in consequence of this proposal; and afterwards, when Charles XII. entered the province to recover it, Patkul commanded in the Saxon army against him. Charles was victorious; and Patkul, some time afterwards, being disgusted at the haughty behaviour of General Fleming, Augustus's favourite, entered into the service of the Czar, with whom Augustus was in strict alliance, and a little before Charles compelled Augustus to abdicate the throne of Poland, and his subjects to elect Stanislaus in his stead. The Czar sent Patkul, with the title of his ambassador, into Saxony, to prevail with Augustus to meet him at Grodno, that they might confer on the state of their affairs. This conference took place; and immediately afterwards the Czar went from Grodno to quell a rebellion in Astracan. As soon as the Czar was gone, Augustus, to the surprise of all Europe, ordered Patkul, who was then at Dresden, to be seized as a state criminal. By this injurious and unprecedented action, Augustus at once violated the law of nations, and weakened his own interest; for Patkul was not only an ambassador, but an ambassador from the only power that could afford him protection. The cause, however, was this: Patkul had discovered that Augustus's ministers were to propose a peace to Charles upon any terms; and had therefore formed a design to be beforehand with them, and procure a separate peace between Charles and his new master the Czar. The design of Patkul was discovered; and, to prevent its success, Augustus ventured to seize his person, assuring the Czar that he was a traitor, and had betrayed them both.

Augustus was soon after reduced to beg a peace of Charles at any rate; and Charles granted it upon certain conditions, one of which was, that he should deliver up Patkul. This condition reduced Augustus to a very distressful dilemma: the Czar, at this very time, reclaimed Patkul as his ambassador; and Charles demanded, with threats, that he should be put into his hands Augustus therefore contrived an expedient by which he hoped to satisfy both: he sent some guards to deliver Patkul, who was prisoner in the castle of Konigstein, to the Swedish troops; but by secret orders privately dispatched, he commanded the governor to let him escape. The governor, though he received this order in time, yet disappointed its intention by his villany and his avarice. He knew Patkul to be very rich; and having it now in his power to suffer him to escape with impunity, he demanded of Patkul a large sum for the favour: Patkul refused to buy that liberty which he made no doubt would be gratuitously restored, in consequence of the Czar's requisition and remonstrance; and, in the mean time, the Swedish guards arrived with the order for his being delivered up to them. By this party he was first carried to Charles's head quarters at Albranstadt, where he continued three months, bound to a stake with a heavy chain of iron. He was then conducted to Casimir, where Charles ordered him to be tried; and he was by his judges found guilty. His sentence depended upon the king; and after having been kept a prisoner some months, under a guard of Mayerfeldt's regiment, uncertain of his fate, he was, on the 28th of September 1707, towards the evening, delivered into the custody of a regiment of dragoons, commanded by Colonel Nicholas Hielm. On the next day, the 29th, the colonel took the chaplain of his regiment aside, and telling him that Patkul was to die the following day, ordered him to acquaint him with his fate, and prepare him for it. About this very time he was to have been married to a Saxon lady of great quality, virtue, and beauty; a circumstance which renders his case still more affecting. What followed in consequence of the colonel's order to the minister will be related in his own words.

"Immediately after evening service I went to his prison, where I found him lying on his bed. The first compliments over, I entered upon the melancholy duty of my profession, and turning to the officer who had him in charge, told him the colonel's orders were, that I should be alone with his prisoner. The officer having withdrawn, Patkul grasping both my hands in his, cried out with most affecting anxiety and distress, My dear pastor! what are you to declare? what am I to hear? I bring you, replied I, the same tidings that the prophet brought to King Hezekiah, *Set thine house in order, for thou must die.* To-morrow by this time thou shalt be no longer in the number of the living! At this terrible warning he bowed himself upon his bed and burst into tears. I attempted to comfort him, by saying that he must, without all doubt, have often meditated on this subject: Yes, cried he, I know, alas! too well, that we must all die; but the death prepared for me will be cruel and insupportable. I assured him that the manner of his death was to me totally unknown; but, believing that he would be prepared for it, I was sure his soul would be received into the number of happy spirits. Here he rose up, and folding his hands together, Merciful Jesus! let me then die the death of the righteous! A little after, with his face inclined to the wall, where stood his bed, he broke out into this soliloquy: Augustus! O Augustus, what must be thy lot one day! Must thou not answer for all the crimes thou hast committed? He then observed that he was driven out from his country, by a sentence against his life, pronounced for doing what the king himself encouraged him to do, saying to him one day in terms of much kindness, 'Patkul, maintain the rights of your country like a man of honour, and with all the spirit you are capable of. That flying into an enemy's country was also unavoidable, as the country of an ally would not have afforded him protection; but that he was in Saxony a wretched exile, not a counsellor or adviser; that before his arrival every thing was already planned, the alliance with Muscovy signed, and the measures with Denmark agreed upon. 'My inclination, (said he, after a pause) were always to serve Sweden, though the contrary opinion has prevailed. The elector of Brandenburg owed his title of *king of Prussia* to the services I did him; and when, in recompense, he would have given me a considerable sum of money, I thanked him, and rejected the offer; adding, that the reward I most wished for was to regain the king of Sweden's favour by his intercession. This he promised, and tried every possible method to succeed, but without success. After this I laboured so much for the interest of the late emperor in his Spanish affairs, that I brought about what scarce any other man could have effected. The emperor as an acknowledgement gave me an assignment for 50,000 crowns, which I humbly laid at his feet, and only implored his imperial majesty's recommendation of me to my king's favour: this request he immediately granted, and gave his orders accordingly, but in vain. Yet, not to lose any opportunity, I went to Moscow while the Swedish ambassadors were at that court; but even the mediation of the Czar had no effect. After that I distributed among the Swedish prisoners at Moscow at least 100,000 crowns, to show the ardent desire I had, by all ways, to regain the favour of their sovereign. Would to heaven I had been equally in earnest to obtain the grace of God.'—At these words another shower of tears fell from his eyes, and he remained for some moments silent, and overwhelmed with grief. I used my best endeavours to comfort him with the assurance that this grace would not be denied him, provided he spent the few hours still left in earnestly imploring it; for the door of heaven's mercy was never shut, though that of men might be cruelly so. 'This (replied he), this is my consolation; for thou art God and not man, to be angry for ever.' He then inveighed bitterly against Augustus, and reproached himself for having any connection with a wretch who was wholly destitute of all faith and honour, an atheist, without piety, and without virtue. 'While he was at Warsaw (said he), and heard the king was advancing to attack him, he found himself extremely distressed. He was absolutely without money, and therefore obliged to dismiss some of his troops. He had recourse to my assistance, and intreated me, for the love of God, to borrow whatever sum I could. I procured him 400,000 crowns; 50,000 of which, the very next day, he squandered on trinkets and jewels, which he gave in presents to some of his women. I told him plainly my thoughts of the matter; and by my importunity prevailed, that the Jews should take back their toys, and return the money they had been paid for them. The ladies were enraged; and he swore that I should one time or other suffer for what I had done: there indeed he kept his word; would to God he had always done so with those he employed!' I now left him for a short time, and at seven in the evening I returned; and the officer being retired, he accosted me with a smiling air, and an appearance of much tranquillity, 'Welcome, dear sir, the weight that lay heavy on my heart is removed, and I already feel a sensible change wrought in my mind. I am ready to die: death is more eligible than the solitude of a long imprisonment. Would to heaven only that the kind of it were less cruel. Can you, my dear sir, inform me in what manner I am to suffer?' I answered, that it had not been communicated to me; but that I imagined it would pass over without noise, as only the colonel and myself had notice of it. 'That (replied he) I esteem as a favour; but have you seen the sentence? or must I die, without being either heard or condemned? My apprehensions are of being put to intolerable tortures.' I comforted him in the kindest manner I could; but he was his own best comforter from the Word of God, with which he was particularly acquainted; quoting, among many other passages, the following in Greek, *We must enter into the kingdom of heaven through many tribulations.* He then called for pen and ink, and intreated me to write down what he should dictate. I did so, as follows:

'*Testamentum, or my last will as to the disposition of my effects after my death.*—I. His majesty King Augustus, having first examined his conscience thoroughly, will be so just as to pay back to my relations the sum he owes me; which being liquidated, will amount to 50,000 crowns; and as my relations are here in the service of Sweden, that monarch will probably obtain it for them.'

"At this he said, let us stop here a little; I will quickly return to finish this will; but now let us address ourselves to God by prayer. Prayers being ended, 'Now (cried he) I find myself yet better, yet in a quieter frame of mind: Oh! were my death less dreadful, with what pleasure would I expiate my guilt by embracing it!—Yes (cried he, after a pause), I have friends in different places, who will weep over my deplorable fate. What will the mother of the king of Prussia say? What will be the grief of the Countess Levolde, who attends on her? But what thoughts must arise in the bosom of *her* to whom my faith is plighted? Unhappy woman! the news of my death will be fatal to her peace of mind. My dear pastor, may I venture to beg one favour of you?' I assured him he might command every service in my power. 'Have the goodness then (said he, pressing my hand), the moment I am no more, to write—Alas! how will you set about it? a letter to Madam Einseidelern, the lady I am promised to—Let her know that I die her's; inform her fully of my unhappy fate: Send her my last and eternal farewell! My death is in truth disgraceful; but my manner of meeting it will, I hope by heaven's and your assistance, render it holy and blessed. This news will be her only consolation. Add farther, dear Sir, that I thanked her with my latest breath for the sincere affection she bore me: May she live long and happy: This is my dying wish.'—I gave him my hand in promise that I would faithfully perform all he desired.

"Afterwards he took up a book: 'This (said he) is of my own writing. Keep it in remembrance of me, and as a proof of my true regard for religion. I could wish it might have the good fortune to be presented to the king, that he may be convinced with what little foundation I have been accused of atheism.' Taking it from his hand, I assured him that my colonel would not fail to present it as soon as opportunity offered.

"The rest of his time was employed in prayer, which he went through with a very fervent devotion. On the 30th of September I was again with him at four in the morning. The moment he heard me he rose, and r dering thanks to God, assured me he had not slept soundly for a long time. We went to prayers; and truth his piety and devout frame of mind were wor of admiration. About six he said he would begin confession, before the din and clamour of the peo without could rise to disturb his thoughts. He t kneeled down, and went through his confession i manner truly edifying. The sun beginning to app above the horizon, he looked out of the window, sayi *Salve festa dies!* 'This is my wedding-day. I look alas! for another, but this is the happier; for to- shall my soul be introduced by her heavenly bridegro into the assembly of the blessed!' He then asked whether I yet knew in what way he was to die? I swered, that I did not. He conjured me, by the sac name of Jesus, not to forsake him; for that he sho find in my company some consolation even in the mi of tortures. Casting his eye on the paper that lay the table, 'This will (said he) can never be finishe I asked him, whether he would put his name to w was already written? 'No (replied he, with a d sigh), I will write that hated name no more. My re tions will find their account in another place; sal them for me.' He then addressed himself again to G in prayer, and continued his devotions till the lieuten entered to conduct him to the coach. He wrapped hi self up in his cloak, and went forward a great pa guarded by 100 horsemen. Being arrived at the pl of execution, we found it surrounded by 300 foot s diers; but at the sight of the stakes and wheels, his h ror is not to be described. Clasping me in his ar 'Beg of God (he exclaimed) that my soul may not thrown into despair amidst these tortures!' I comfort I adjured him to fix his thoughts on the death of Je Christ, who for our sins was nailed to a cross.

"Being now on the spot where he was to suffer, bid the executioner to do his duty well, and put into hands some money which he got ready for that purpo He then stretched himself out upon the wheel; a while they were stripping him naked, he begged me pray that God would have mercy on him, and bear his soul in agony. I did so; and turning to all spectators, said to them, Brethren, join with me prayer for this unhappy man. 'Yes (cried he), ass me all of you with your supplications to heaven.' H the executioner gave him the first stroke. His cries we terrible: 'O Jesus! Jesus! have mercy upon me.' T cruel scene was much lengthened out, and of the utm horror; for as the headsman had no skill in his busine the unhappy victim received upwards of 15 seve blows, with each of which were intermixed the m piteous groans and invocations of the name of God. length, after two strokes given on the breast, his streng and voice failed him. In a faultering dying tone, was just heard to say, 'Cut off my head?' and the ex cutioner still lingering, he himself placed his head the scaffold: After four strokes with an hatchet, t head was separated from the body, and the body qua tered. Such was the end of the renowned Patkul."

Charles XII. has been very generally and severe censured for not pardoning him, and we are not inclin to vindicate the sovereign. Yet it must be remembere that Patkul was guilty of a much greater crime th that which drew upon him the displeasure of Charl

XI. He incited foreign powers to attack his country when under the government of a boy, hoping, as he said himself, that it would in such circumstances become an easy conquest. He was therefore a rebel of the worst kind; and where is the absolute monarch that is ready to pardon such unnatural rebellion? Let it be remembered, too, that Charles, amongst whose faults no other instance of cruelty has been numbered, certainly thought that, in ordering the execution of Patkul, he was discharging his duty. That monarch, it is known, believed in the possibility of discovering the philosopher's stone. Patkul, when under sentence of death, contrived to impose so far upon the senate at Stockholm, as to persuade them that he had, in their presence, converted into gold a quantity of baser metal. An account of this experiment was transmitted to the king, accompanied with a petition to his majesty for the life of so valuable a subject; but Charles, blending magnanimity with his severity, replied with indignation, that he would not grant to interest what he had refused to the call of humanity and the intreaties of friendship.

PATMOS, in *Ancient Geography*, one of the Sporades (Dionysius); 30 miles in compass (Pliny); concerning which we read very little in authors. It was rendered famous by the exile of St John, and the Revelation showed him there. The greatest part of interpreters think that St John wrote them in the same place during the two years of his exile; but others think that he did not commit them to writing till after his return to Ephesus. The island of Patmos is between the island of Icaria and the promontory of Miletus. Nothing has done it more honour than to have been the place of the banishment of St John. It is now called *Patino*, or *Pactino*, or *Patmol*, or *Palmosa*. Its circuit is five and twenty or thirty miles. It has a city called *Patmos*, with a harbour, and some monasteries of Greek monks. It is at present in the hands of the Turks. It is considerable for its harbours; but the inhabitants derive little benefit from them, because the corsairs have obliged them to quit the town, and retire to a hill on which St John's convent stands. This convent is a citadel consisting of several irregular towers, and is a substantial building seated on a very steep rock. The whole island is very barren, and without wood; however, it abounds with partridges, rabbits, quails, turtles, pigeons, and snipes. All their corn does not amount to 1000 barrels in a year. In the whole island there are scarcely 300 men; but there are above 20 women to one man, who expect that all strangers who land in the island should carry some of them away. To the memory of St John is an hermitage on the side of a mountain, where there is a chapel not above eight paces long and five broad. Over head they show a chink in the rock, through which they pretend that the Holy Ghost dictated to St John. E. Long. 26. 84. N. Lat. 37. 24.

PATNA, a town of Hindoostan, where the English have factories for saltpetre, borax, and raw silk. It is the capital of the province of Bahar, a dependency of Bengal, in the empire of Hindoostan, situated in a pleasant country, 400 miles east of Agra. It extends seven miles in length on the banks of the Ganges, and is about half a mile in breadth.—Mr Rennel gives strong reasons for supposing it to be the ancient PALIBOTHRA. The town is large, but the houses are built at a distance from each other. The number of inhabitants is estimated at 150,000. E. Long. 85. 15. N. Lat. 25. 37.

PATOMACK, a large river of Virginia, in North America, which rises in the Alleghany mountains, separates Virginia from Maryland, and falls into Chesapeake bay. It is navigable for near 300 miles. Washington is situated on its north bank.

PATONCE, in *Heraldry*, is a cross, flory at the ends; from which it differs only in this, that the ends instead of turning down like a fleur-de-lis, are extended somewhat in the pattee form. See FLORY.

PATRÆ, a city of Achaia. This place was visited by Dr Chandler, who gives the following account of it. "It has often been attacked by enemies, taken, and pillaged. It is a considerable town, at a distance from the sea, situated on the side of a hill, which has its summit crowned with a ruinous castle. This made a brave defence in 1447 against Sultan Morat, and held out until the peace was concluded, which first rendered the Morea tributary to the Turks. A dry flat before it was once the port, which has been choked with mud. It has now, as in the time of Strabo, only an indifferent road for vessels. The house of Nicholas Paul, Esq. the English consul, stood on part of the wall either of the theatre or the odeum. By a fountain was a fragment of a Latin inscription. We saw also a large marble bust much defaced; and the French consul showed us a collection of medals. We found nothing remarkable in the citadel. It is a place of some trade, and is inhabited by Jews as well as by Turks and Greeks. The latter have several churches. One is dedicated to St Andrew the apostle, who suffered martyrdom there, and is of great sanctity. It had been recently repaired. The site by the sea is supposed that of the temple of Ceres. By it is a fountain. The air is bad, and the country round about overrun with the low shrub called *glycyrrhiza* or liquorice."

Of its ancient state, the same author speaks thus: "Patræ assisted the Ætolians when invaded by the Gauls under Brennus; but afterwards was unfortunate, reduced to extreme poverty, and almost abandoned. Augustus Cæsar reunited the scattered citizens, and made it a Roman colony, settling a portion of the troops which obtained the victory of Actium, with other inhabitants from the adjacent places. Patræ reflourished and enjoyed dominion over Naupactus, Oeanthé, and several cities of Achaia. In the time of Pausanias, Patræ was adorned with temples and porticoes, a theatre, and an odéum which was superior to any in Greece but that of Atticus Herodes at Athens. In the lower part of the city was a temple of Bacchus Æsymnetes, in which was an image preserved in a chest, and conveyed, it was said, from Troy by Eurypylus; who, on opening it, became disordered in his senses. By the port were temples; and by the sea, one of Ceres, with a pleasant grove and a prophetic fountain of unerring veracity in determining the event of any illness. After supplicating the goddess with incense, the sick person appeared, dead or living, in a mirror suspended so as to touch the surface of the water. In the citadel of Patræ was a temple of Diana Laphria, with her statue in the habit of a huntress, of ivory and gold, given by Augustus Cæsar when he laid waste Calydon and the cities of Ætolia to people Nicopolis. The Patrensians honoured her with a yearly festival, which is described by Pausanias who was a spectator. They formed a circle round the altar with pieces of green wood, each 16 cubits long, and within heaped dry fuel. The solemnity began with a most magnificent procession, which was closed by the virgin-priestess in a chariot drawn by stags. On the following day, the city and private persons offered at the altar fruits, and birds, and all kinds of victims, wild-boars, stags, deer, young wolves, and beasts full grown; after which the fire was kindled. He relates, that a bear and another animal forced a way through the fence, but were reconducted to the pile. It was not remembered that any wound had ever been received at this ceremony, though the spectacle and sacrifice were as dangerous as savage. The number of women at Patræ was double that of the men. They were employed chiefly in a manufacture of flax which grew in Ellis, weaving garments, and attire for the head."

PATRANA, or PASTRANA, a town of New Castile in Spain, with the title of a duchy. It is seated between the rivers Tajo and Tajuna, in W. Long. 2. 45. N. Lat. 40. 26.

PATRAS, an ancient town of European Turkey, in the Morea, with a Greek archbishop's see. It contains about 440 families; and the Jews, who are one-third part of the inhabitants, have four synagogues. There are several handsome mosques and Greek churches. The Jews carry on a trade in silk, leather, honey, wax, and cheese. There are cypress trees of a prodigious height, and excellent pomegranates, citrons, and oranges. It stands at a little distance from the sea, and its port is now choaked up with mud. It is in the hands of the Turks. E. Long. 21. 45. N. Lat. 38. 17.

PATRICA, a town of Italy, in the territory of the church, and in the Campagna of Rome, towards the sea-coast, and eight miles east of Ostia. About a mile from this place is a hill called *Monte de Livano*, which some have thought to be the ancient Lavinium founded by Æneas.

PATRES CONSCRIPTI. See CONSCRIPT and SENATOR.

PATRIARCH, PATRIARCHA, one of those first fathers who lived towards the beginning of the world, and who became famous by their long lines of descendants. Abraham, Isaac, and Jacob, and his twelve sons, are the patriarchs of the Old Testament; Seth, Enoch, &c. were antediluvian patriarchs.

The authority of patriarchal government existed in the fathers of families, and their first-born after them, exercising all kinds of ecclesiastical and civil authority in their respective households; and to this government, which lasted till the time of the Israelites dwelling in Egypt, some have ascribed an absolute and despotic power, extending even to the punishment by death. In proof of this, is produced the curse pronounced by Noah upon Canaan (Gen ix. 25.); but it must be observed, that in this affair Noah seems to have acted rather as a prophet than a patriarch. Another instance of supposed despotic power is Abraham's turning Hagar and Ishmael out of his family (Gen. xxi. 9, &c.); but this can hardly be thought to furnish evidence of any singular authority vested in the patriarchs, as such, and peculiar to those ages. The third instance brought forward to the same purpose is that of Jacob's denouncing a curse upon Simeon and Levi (Gen. xlix. 7.), which is maintained by others to be an instance of prophetic inspiration than of patriarchal power. The fourth instance is of Judah with regard to Tamar (Gen. xxxviii. 24.); regard to which it is remarked, that Jacob, the fath Judah, was still living; that Tamar was not one own family; and that she had been guilty of adul the punishment of which was death by burning; that Judah on this occasion might speak only as a p cutor.

On the whole, however, it is difficult to say whi these opinions is most agreeable to truth. Men believe the origin of civil government, and the ob tion to obedience, to arise from a supposed original tract, either real or implied, will be naturally l weaken the authority of the patriarchs: and again who esteem government to be a divine institu will be as apt to raise that authority to the highest that either reason or scripture will permit them. cannot be denied, that authority existed in fathers, descended to their first-born, in the first ages of world; and it is neither unnatural nor improbabl imagine, that the idea of hereditary power and he tary honours was first taken from this circumsta But whether authority has descended through fa and son in this way to our times, is a circumst that cannot in one instance be asserted, and can be nied in a thousand. The real source of the dig and of the authority of modern times seems to h been, skill in the art of war, and success in the con of conquests.

Jewish PATRIARCH, a dignity, respecting the ori of which there are a variety of opinions. The lear authors of the Universal History think, that the f appearance and institution of those patriarchs happe under Nerva the successor of Domitian. It seems p bable that the patriarchs were of the Aaronic or Le tical race; the tribe of Judah being at that time much depressed, and too obnoxious to the Romans to able to assume any external power. But of whate tribe they were, their authority came to be very con derable. Their principal business was to instruct people; and for this purpose they instituted schools several cities. And having gained great reputation their extraordinary learning, zeal, and piety, they mig in time, not only bring a great concourse of other Je from other parts, as from Egypt and other western p vinces of their dispersion, but likewise prove the me of their patriarchal authority's being acknowled there. From them they ventured at length to lev kind of tribute, in order to defray the charges of th dignity, and of the officers, (viz. the *Apostoli* or *Legat* under them, whose business it was to carry their ord and decisions through the other provinces of their d persion, and to see them punctually executed by all, t some shadow of union at least might be kept up amo the western Jews. They likewise nominated the doct who were to preside over their schools and academie and these were in process of time styled *chiefs* and *pr ces*, in order to raise the credit of that dignity, or to i ply the great regard which their disciples were to p to them. These chiefs became at length rivals of t patriarchs; and some of them possessed both dignities once; an usurpation which caused not only great conf sion amongst them, but oftentimes very violent a bloody contests. However, as the Jewish Rabbies ha trumped up a much older era for this patriarchal dignity, and have given us a succession of them down to the fifth century, in which it was abolished, it will not be amiss to give our readers the substance of what they have written of the rise and progress of this order of men; and at the same time to show them the absurdity and falsehood of that pretended succession to this imaginary dignity.

According to them, the first patriarch was Hillel, surnamed the *Babylonian*, because he was sent for from thence to Jerusalem about 100 years before the ruin of their capital, or 30 years before the birth of Christ, to decide a dispute about the keeping of Easter, which on that day fell out on the Sabbath-day; and it was on account of his wise decision that he was raised to that dignity, which continued in his family till the said fifth century. He was likewise looked upon as a second Moses, because he lived like him 40 years in obscurity, 40 more in great reputation for learning and sanctity, and 40 more in possession of this patriarchal dignity. They make him little inferior to that lawgiver in other of his excellencies, as well as in the great authority he gained over the whole Jewish nation. The wonder will be, how Herod the Great, who was so jealous of his own power, could suffer a stranger to be raised to such a height of it, barely for having decided a dispute which must in all likelihood have been adjudged by others long before that time.

However, Hillel was succeeded by his son Simeon, whom many Christians pretend to have been the venerable old person of that name, who received the divine infant in his arms. The Jews give him but a very obscure patriarchate; though the authors above quoted make him, moreover, chief of the sanhedrim; and Epiphanius says, that the priestly tribe hated him so much for giving so ample a testimony to the divine child, that they denied him common burial. But it is hardly credible that St Luke should have so carelessly passed over his twofold dignity, if he had been really possessed of them, and have given him no higher title than that of a just and devout man.

He was succeeded by Jochanan, not in right of descent, but of his extraordinary merit, which the Rabbies, according to custom, have raised to so surprising a height, that, according to them, if the whole heavens were paper, all the trees in the world pens, and all the men writers, they would not suffice to pen down all his lessons. He enjoyed his dignity but two years, according to some, or five according to others: and was the person who, observing the gates of the temple to open of their own accord, cried out, "O temple, temple! why art thou thus moved! We know that thou art to be destroyed, seeing Zechariah hath foretold it, saying, "Open thy gates, O Lebanus, and let the flames consume thy cedars." Upon this he is further reported to have complimented Vespasian, or rather, as some have corrected the story, Titus, with the title of *king*, assuring him that it was a royal person who was to destroy that edifice; on which account they pretend that general gave him leave to remove the sanhedrim to Japhne.

The Jewish writers add, that he likewise erected an academy there, which subsisted till the death of Akiba; and was likewise the seat of the patriarch; and consisted of 300 schools, or classes of scholars. Another he erected at Lydda, not far from Japhne, and where the Christians have buried their famed St George. He lived 120 years, and being asked, what he had done to prolong his life? he gave this wise answer; I never made water nearer a house of prayer than four cubits; I never disguised my name: I have taken care to celebrate all festivals: and my mother hath even sold my head ornaments to buy wine enough to make me merry on such days; and left me at her death 300 hogsheads of it, to sanctify the Sabbath.—The doctors who flourished in his time were no less considerable, both for their number and character; particularly the famed Rabbi Chanina, of whom the Bath Col was heard to say, that the world was preserved for the sake of him; and R. Nicodemus, whom they pretend to have stopped the course of the sun, like another Joshua.

He was succeeded by Gamaliel, a man, according to them, of unsufferable pride; and yet of so universal authority over all the Jews, not only in the west, but over the whole world, that the very monarchs suffered his laws to be obeyed in their dominions, not one of them offering to obstruct the execution of them. In his days flourished Samuel the Less, who composed a prayer full of the bitterest curses against heretics, by which they mean the Christians; and which are still in use to this day. Gamaliel was no less an enemy to them; and yet both have been challenged, the former as the celebrated master of our great apostle, the other as his disciple in his unconverted state.

Simon II. his son and successor was the first martyr who died during the siege of Jerusalem. The people so regretted his death, that an order was given, instead of 10 bumpers of wine, which were usually drank at the funeral of a saint, to drink 13 at his, on account of his martyrdom. These bumpers were in time multiplied, they tell us, to such shameful height, that the sanhedrim was forced to make some new regulations to prevent that abuse.

These are the patriarchs which, the Rabbies tell us, preceded the destruction of the temple; and we need no farther confutation of this pretended dignity, than the silence of the sacred historians, who not only make not the least mention of it, but assure us all along that they were the high-priests who presided in the sanhedrim; and before whom all cases relating to the Jewish religion were brought and decided. It was the high-priest who examined and condemned our Saviour; that condemned St Stephen; that forbade the apostles to preach in Christ's name; and who sat as judge on the great apostle at the head of that supreme court. The same may be urged from Josephus, who must needs have known and mentioned this pretended dignity, if any such there had been; and yet is so far from taking the least notice of it, that, like the evangelists, he places the pontiffs alone at the head of all the Jewish affairs; and names the high-priest Ananus as having the care and direction of the war against the Romans;—which is an evident proof that there were then no such patriarchs in being.

To all this let us add, that if there had been any such remarkable succession, the Talmudists would have preserved it to future ages; whereas, neither they, nor any of the ancient authors of the Jewish church, make any mention of it; but only some of their doctors, who have written a considerable time after them, as of writers to whom little credit can be given in points of this nature; especially as there are such unsurmountable contradictions between them, as no authors either Jewish or Christian have, with all their pains, been hitherto able to reconcile.

Their succession, according to the generality of those rabbies, stands as follows:

1. Hillel the Babylonian. 2. Simeon the son of Hillel. 3. Gamaliel the son of Simeon. 4. Simeon II. the son of Gamaliel. 5. Gamaliel II. the son of Simeon II. 6. Simeon III. the son of Gamaliel II. 7. Judah the son of Simeon III. 8. Gamaliel III. the son of Judah. 9. Judah II. the son of Gamaliel III. 10. Hillel II. son of Judah II. 11. Judah III. son of Hillel II. 12. Hillel III. son of Judah III. 13. Gamaliel IV. son of Hillel III.

According to Gants Tzemach David, who hath reduced them to 10, they are,

1. Hillel the Babylonian. 2. Simeon the son of Hillel. 3. Rabb. Gamaliel Rebona. 4. R. Simeon the son of Gamaliel. 5. Rabban Gamaliel his son. 6. R. Jehudah the prince. 7. Hillel the prince, his son. 8. Rabban Gamaliel the Old. 9. Simeon III. 10. R. Judah, Nassi or prince.

On the whole, it cannot be doubted but that their first rise was in Nerva's time, however much Jewish pride may have prompted them to falsify, and to assert their origin to have been more ancient that it really was. Nor have the Jews been faithful in giving an account of the authority of these men. They have exaggerated their power beyond all bounds, for the purpose of repelling the arguments of Christians: for their power was certainly more showy than substantial. In time, however, they certainly imposed upon the people; and what power they did possess (which the Romans only allowed to be in religious matters, or in such as were connected with religion) they exercised with great rigour. Their pecuniary demands, in particular, became very exorbitant; and was the cause of their suppression in the year 429.

Patriarchs, among Christians, are ecclesiastical dignitaries, or bishops, so called from their paternal authority in the church. The power of patriarchs was not the same in all, but differed according to the different customs of countries, or the pleasures of kings and councils. Thus the patriarch of Constantinople grew to be a patriarch over the patriarchs of Ephesus and Cæsa
and was called the *œcumenical and universal patria*
and the patriarch of Alexandria had some preroga
which no other patriarch but himself enjoyed, suc
the right of consecrating and approving every singl
shop under his jurisdiction.

The patriarchate has been ever esteemed the sup
dignity in the church: the bishop had only under
the territory of the city of which he was bishop
metropolitan superintended a province, and had for
fragans the bishops of his province; the primate
the chief of what was then called a *diocese* (A), anc
several metropolitans under him; and the patriarch
under him several dioceses, composing one exarcl
and the primates themselves were under him.

Usher, Pagi, De Marca, and Morinus, attribute
establishment of the grand patriarchates to the apo
themselves; who, in their opinion, according to the
scription of the world then given by geographers, pi
ed on the three principal cities in the three parts o
known world; viz. Rome in Europe, Antioch in A
and Alexandria in Africa: and thus formed a trinit
patriarchs. Others maintain that the name patri
was unknown at the time of the council of Nice;
that for a long time afterwards patriarchs and prim
were confounded together, as being all equally chie
dioceses, and equally superior to metropolitans,
were only chiefs of provinces. Hence Socrates g
the title patriarch to all the chiefs of dioceses, and
kons ten of them. Indeed, it does not appear that the
nity of patriarch was appropriated to the five grand
of Rome, Constantinople, Alexandria, Antioch, and
rusalem, till after the council of Chalcedon in 451;
when the council of Nice regulated the limits and
rogatives of the three patriarchs of Rome, Antioch,
Alexandria, it did not give them the title of patriar
though it allowed them the pre-eminence and privile
thereof; thus when the council of Constantinople
judged the second place to the bishop of Constantino
who till then was only a suffragan of Heraclea, it s
nothing of the patriarchate. Nor is the term *pa*
arch found in the decree of the council of Chalced
whereby the fifth place is assigned to the bishop
Jerusalem; nor did these five patriarchs govern all
churches.

Th

(A) The word diocese was then of very different import from what it bears now. Under the article EPISCO
CY, it was observed, that the first founders of churches regulated their extent and the jurisdiction of their bish
by the divisions of the Roman empire into civil jurisdictions. One of these divisions was into provinces
dioceses. A province comprised the cities of a whole region subjected to the authority of one chief magistra
who resided in the metropolis or chief city of the province. A diocese was a still larger district, comprehendi
within it several provinces, subject to the controul of a chief magistrate, whose residence was in the metropo
of the diocese. The jurisdiction of the bishops of the Christian church was established upon this model. T
authority of a private bishop extended only over the city in which he resided, together with the adjacent villa
and surrounding tract of country. This district was called παροικια, though it comprehended many parishes
the modern sense of that word. Under Arcadius and Honorius the empire was divided into thirteen diocese
1. The Oriental diocese, containing fifteen provinces; 2. The diocese of Egypt, six provinces; 3. The Asia
diocese, ten provinces; 4. The Pontic diocese, ten provinces; 5. The diocese of Thrace, six provinces; 6. T
diocese of Macedonia, six provinces; 7. The diocese of Decia, five provinces; 8. The Italic diocese, sevente
provinces; 9. The diocese of Illyricum, six provinces; 10. The diocese of Africa, six provinces; 11. The Spani
diocese, seven provinces; 12. The Gallican diocese, seventeen provinces; 13. The Britannic diocese, five pr
vinces. Each of these provinces comprehended many παροικιαι, and each παροικια many modern parishes. S
Bingham's Origines Sacræ, Book ix.

There were besides many independent chiefs of dioceses, who, far from owning the jurisdiction of the grand patriarchs, called themselves *patriarchs*; such as that of Aquileia: nor was Carthage ever subject to the patriarch of Alexandria. Mosheim * imagines that the bishops, who enjoyed a certain degree of pre-eminence over the rest of their order, were distinguished by the Jewish title of patriarchs in the fourth century. The authority of the patriarchs gradually increased, till, about the close of the fifth century, all affairs of moment within the compass of their patriarchate came before them, either at first hand or by appeals from the metropolitans. They consecrated bishops; assembled yearly in council the clergy of their respective districts; pronounced a decisive judgment in those cases where accusations were brought against bishops; and appointed vicars or deputies, clothed with their authority, for the preservation of order and tranquillity in the remoter provinces. In short, nothing was done without consulting them; and their decrees were executed with the same regularity and respect as those of the princes.

It deserves to be remarked, however, that the authority of the patriarchs was not acknowledged through all the provinces without exception. Several districts, both in the eastern and western empires, were exempted from their jurisdiction. The Latin church had no patriarchs till the sixth century; and the churches of Gaul, Britain, &c. were never subject to the authority of the patriarch of Rome, whose authority only extended to the suburbicary provinces. There was no primacy, no exarchate nor patriarchate, owned here; but the bishops with the metropolitans, governed the church in common. Indeed, after the name patriarch became frequent in the west, it was attributed to the bishops of Bourges and Lyons; but it was only in the first signification, viz. as heads of dioceses. Du Cange says, that there have been some abbots who have borne the title of patriarchs.

PATRIARCHAL CROSS, in *Heraldry*, is that where the shaft is twice crossed; the lower arms being longer than the upper ones.

PATRICIAN, a title given, among the ancient Romans, to the descendants of the hundred, or, as some will have it, of the two hundred, first senators chosen by Romulus; and by him called *patres*, "fathers." Romulus established this order after the example of the Athenians; who were divided into two classes, viz. the *ευπατριδας*, *patricios*, and *δημοτικους*, *populares*. Patricians, therefore, were originally the nobility; in opposition to the plebeians. They were the only persons whom Romulus allowed to aspire to the magistracy; and they exercised all the functions of the priesthood till the year of Rome 495. But the cognizance and character of these ancient families being almost lost and extinguished by a long course of years, and frequent changes in the empire, a new kind of patricians were afterwards set on foot, who had no pretensions from birth, but whose title depended entirely on the emperor's favour. This new patriciate, Zozimus tells us, was erected by Constantine, who conferred the quality on his counsellors, not because they were descended from the ancient fathers of the senate, but because they were the fathers of the republic or of the empire. This dignity in time became the highest of the empire. Justinian calls it *summum dignitatem*. In effect, the patricians seem to have had the precedence of the *consulares*, and to have taken place before them in the senate; though F. Faber asserts the contrary. What confounds the question is, that the two dignities often met in the same person; because the patriciate was only conferred on those who had gone through the first offices of the empire, or had been consuls. Pope Adrian made Charlemagne take the title of patrician before he assumed the quality of emperor; and other popes have given the title to other kings and princes by reason of its eminence.

PATRICIAN is also a title of honour often conferred on men of the first quality in the time of our Anglo-Saxon kings. See THANE.

PATRICIAN Deities, *Patricii Dii*, in *Mythology*, were Janus, Saturn, the Genius, Pluto, Bacchus, the Sun, the Moon, and the Earth.

PATRICIANS, in ecclesiastical writers, were ancient sectaries, who disturbed the peace of the church in the beginning of the third century: thus called from their founder *Patricius*, preceptor of a Marcionite called *Symmachus*. His distinguishing tenet was, that the substance of the flesh is not the work of God, but that of the devil: on which account his adherents bore an implacable hatred to their own flesh; which sometimes carried them so far as to kill themselves. They were also called TATIANITES, and made a branch of the ENCRATITÆ.

PATRICK, ST, the apostle of Ireland, and second bishop of that country. He was born April 5th A. D. 373, of a good family, at Kirk Patrick near Dumbarton, in what is now called Scotland, but then comprehended under the general name of Britain.—His baptismal name *Suceath*, signifies, in the British language, "valiant in war." On some inroad of certain exiles from Ireland he was taken prisoner, and carried into that kingdom, where he continued six years in the service of Milcho, who had bought him of three others, when Patrick acquired the new name of *Cothraig*, or *Ceathar-Tigh*, i. e. *four families*. In this time he made himself master of the Irish language, and at last made his escape, and returned home on board a ship. About two years after, he formed a design of converting the Irish either in consequence of a dream, or of reflection on what he had observed during his acquaintance with them. The better to qualify himself for this undertaking, he travelled to the continent, where he continued 35 years, pursuing his studies under the direction of his mother's uncle St Martin, bishop of Tours, who had ordained him deacon; and after his death, with St German, bishop of Auxerre, who ordained him priest, and gave him his third name *Mawn* or *Maginim*.

An ancient author, Henricus Antisioderensis, who wrote a book concerning the miracles of St German, considers it as the highest honour of that prelate to have been the instructor of St Patrick: "As the glory of a father shines in the government of his sons; out of the many disciples in religion who are reported to have been his sons in Christ, suffice it briefly to mention one by far the most famous, as the series of his actions shows, Patrick the particular apostle of Ireland, who being under his holy discipline 18 years, derived no little knowledge in the inspired writings from such a source. The most godly divine pontiff, considering him alike distinguished in religion, eminent for virtue, and stedfast in doctrine; and thinking it absurd to let one of the least labourers remain inactive in the Lord's vineyard, recommended him to Celestine, pope of Rome, by his presbyter Segetius, who was to carry to the apostolic see a tetimonial of ecclesiastical merit of this excellent man. Approved by his judgment. supported by his authority, and confirmed by his blessing, he set out for Ireland; and being peculiarly destined to that people as their apostle, instructed them at that time by his doctrine and miracles; and now does and will forever display the wonderful power of his apostleship." Lastly, Pope Celestine consecrated him bishop, and gave him his most familiar name *Patricius*, expressive of his honourable descent; and to give lustre and weight to the commission which he now charged him with to convert the Irish. Palladius had been here a year before him on the same design, but with little success: the saints Kieran, Ailbe, Declan, and Ibar, were precursors both to Palladius and Patrick. But the great office of apostle of Ireland was reserved for our prelate, who landed in the country of the Evolein, or at Wicklow,, A. D. 441. His first convert was Sinell, eighth in descent from Cormac king of Leinster; but not meeting with encouragement, he proceeded to Dublin, and thence to Ulster, where he founded a church (afterwards the famous abbey of Saul, in the county of Down), remarkable for its position, being made out of a barn, and its greatest length reaching from north to south After labouring seven years indefatigably in his great work, he returned to Britain, which he delivered from the heresies of Pelagius and Arius; engaged several eminent persons to assist him; visited the isle of Man, which he converted in 440, when the bishopric was founded; and, A. D. 448, returned to the see of Armagh (A), which he had founded three years before; and in 13 years more completed the conversion of the whole island (B). After giving an account of his commission at Rome, he once more returned hither, and spent the remainder of his life between the monasteries of Armagh and Saul, superintending and enforcing the great plan of doctrine and discipline which he had established. After having established schools, or an academy here, he closed his life and ministry at Saul abbey, in the 120th year of his age, March 17. A. D. 493, and was buried at Down afterwards, in the same grave with St Bridget and St Columb, in the same place. Respecting his burial-place, however, there have been great disputes; and it has been as great a subject of debate with the religious, as Homer's birthplace was formerly among the cities of Greece. Those of Down lay claim to it, on the authority of the follo ing verses:

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* Eccles. Hist. vol. i p. 254.

> These three in Down lie in tomb one,
> Briget, Patricius, and Columba pious.

Those of Glastenbury in England, from the old mo ments of their church: And some Scots affirm him have been both born and buried among them at Gl gow. His genuine works were collected and printed Sir James Ware, 1656. His immediate successor this see was St Binen or Begnus.

Order of St PATRICK, an institution which took pl in Ireland in the year 1783. On the fifth of Feb ary, in that year, the king ordered letters-patent be passed under the great seal of the kingdom of I land, for creating a society or brotherhood, to be call *knights of the illustrious order of St Patrick*, of which majesty, his heirs and successors, shall perpetually sovereigns, and his majesty's lieutenant-general a general-governor of Ireland, &c. for the time bei shall officiate as grand-master; and also for appointi Prince Edward, and several of the prime nobility of I land, knights companions of the said illustrious order.

PATRICK, *Simon*, a very learned English bish was born at Gainsborough in Lincolnshire in 162 In 1644 he was admitted into Queen's college, Ca bridge, and entered into holy orders. After being some time chaplain to Sir Walter St John, and vicar the church at Battersea in Surrey, he was preferred the rectory of St Paul's, Covent-garden, in Lond where he continued all the time of the plague in 16 among his parishioners, to their great comfort. 1668 he published his Friendly Debate between a Co formist and a Nonconformist. This was answered the Dissenters, whom he had much exasperated by i but by his moderation and candour toward them afte wards, they were perfectly reconciled to him, and brought over many of them to the communion of t established church. In 1678 he was made dean Peterborough, where he was much beloved. In 168 Dr Lewis de Moulin, who had been a history-profe sor at Oxford, and written many bitter books again the church of England, sent for Dr Patrick upon h sick bed, and made a solemn declaration of his regr on that account, which he signed, and it was publis ed after his death. During the reign of King Jame the dean's behaviour shewed that he had nothing mo at heart than the Protestant religion; for which ventured all that was dear to him, by preaching an writin

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(A) At Armagh St Patrick founded, A. D. 445 or 447, a priory of Augustine canons, dedicated to St Pete and St Paul, much enriched by the archbishops; restored by Imar O Hedegan in the 12th century. It was granted, A. D. 1611, to Sir Toby Caulfield, knight. St Patrick also founded there a house of canonesses of the sam order, under his sister Lupita, called *Templeua firta*, or the "house of miracles."

We are told, that Armagh was made a metropolitan see in honour of St Patrick; in consequence of which i was held in the highest veneration not only by bishops and priests, but also by kings and bishops, as the venerabl Bede informs us.

(B) There is a cave in the county of Donegal or Tir-connel, near the source of the Liffey, which, it is pretended, was dug by Ulysses, in order to hold conversations with infernals. The present inhabitants call it *Ellan n Fradatory* or the "island of Purgatory, and Patrick's Purgatory." They affirm, with a pious credulity, tha St Patrick the apostle of Ireland, or some abbot of that name, obtained of God by his earnest prayers, that th pains and torments which await the wicked after this life might be here set forth to view, in order the more easil to recover the Irish from their sinful state and heathenish errors.

writing against the errors of the church of Rome. In 1687 he published a prayer composed for that difficult time, when persecution was expected by all who stood firm to their religion. The year after the Revolution, the dean was appointed bishop of Chichester, and was employed with others of the new bishops to settle the affairs of the church in Ireland. In 1691 he was translated to the see of Ely, in the room of the deprived Bishop Turner. He died in 1707, after having published various works; among which the most distinguished are his Paraphrases and Commentaries on the Holy Scriptures, three volumes folio. These, with Lowth on the Proverbs, Arnold on the Apocrypha, and Whitby on the New Testament, make a regular continued commentary in English on all the sacred books.

PATRIMONY, a right or estate inherited by a person from his ancestors.

The term *patrimony* has been also given to church-estates or revenues; in which sense authors still say, the patrimony of the church of Rimini, Milan, &c. The church of Rome hath patrimonies in France, Africa, Sicily, and many other countries. To create the greater respect to the estates belonging to the church, it was usual to give their patrimonies the names of the saints they held in the highest veneration: thus the estate of the church of Ravenna was called the *patrimony of St Apollinarius;* that of Milan, the *patrimony of St Ambrose;* and the estates of the Roman church were called the *patrimony of St Peter in Abruzzo*, the *patrimony of St Peter in Sicily*, and the like.

What is now called *St Peter's patrimony* is only the duchy of Castro, and the territory of Orvietto. See Castro, &c.

PATRIOTISM, a love of one's country, which is one of the noblest passions that can warm and animate the human breast. It includes all the limited and particular affections to our parents, children, friends, neighbours, fellow-citizens, and countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them encroach on those sacred and first regards we owe to the great public to which we belong. Were we solitary creatures, detached from the rest of mankind, and without any capacity of comprehending a public interest, or without affections leading us to desire and pursue it, it would not be our duty to mind it, nor criminal to neglect it. But as we are parts of the public system, and are not only capable of taking large views of its interests, but by the strongest affections connected with it, and prompted to take a share of its concerns, we are under the most sacred ties to prosecute its security and welfare with the utmost ardour, especially in times of public trial.

"Zeal for the public good (says Mr Addison) is the characteristic of a man of honour and a gentleman, and must take place of pleasures, profits, and all other private gratifications: that whosoever wants this motive, is an open enemy, or an inglorious neuter to mankind, in proportion to the misapplied advantages with which nature and fortune have blessed him." This love of our country does not import an attachment to any particular soil, climate, or spot of earth, where perhaps we first drew our breath, though those natural ideas are often associated with the moral ones; and, like external signs or symbols, help to ascertain and bind them; but it imports an affection to that moral system or community, which is governed by the same laws and magistrates, and whose several parts are variously connected one with the other, and all united upon the bottom of a common interest. Wherever this love of our country prevails in its genuine vigour and extent, it swallows up all sordid and selfish regards; it conquers the love of ease, power, pleasure, and wealth; nay, when the amiable partialities of friendship, gratitude, private affection, or regards to a family, come in competition with it, it will teach us to sacrifice all, in order to maintain the rights, and promote and defend the honour and happiness of our country. To pursue, therefore, our private interests in subordination to the good of our country; to be examples in it of virtue, and obedient to the laws; to choose such representatives as we apprehend to be the best friends to its constitution and liberties; and if we have the power, to promote such laws as may improve and perfect it; readily to embrace every opportunity for advancing its prosperity; cheerfully to contribute to its defence and support; and, if need be, to die for it:—these are among the duties which every man, who has the happiness to be a member of our free and Protestant constitution, owes to his country.

The constitution of man is such, that the most selfish passions, if kept within their proper bounds, have a tendency to promote the public good. There is no passion of more general utility than patriotism; but its origin may unquestionably be termed *selfish.* The love of one's relations and friends is the most natural expansion of self-love: this affection connects itself too with local circumstances, and sometimes cannot easily be separated from them. It often varies, as relationship or place varies; but acquires new power when the whole community becomes its object. It was therefore with singular propriety that the poet said, "Self-love and social are the same." Under the article Calais we have already given the outlines of the transactions of its siege by Edward III. during which the inhabitants displayed a degree of *patriotism* truly wonderful. History scarcely affords a more distinguished instance of true patriotic virtue than on this occasion. We shall therefore give a fuller account of this remarkable affair, as one of the best examples that can possibly be selected of the virtue we have been explaining. The inhabitants, under Count Vienne their gallant governor, made an admirable defence against a well disciplined and powerful army. Day after day the English effected many a breach, which they repeatedly expected to storm by morning; but, when morning appeared, they wondered to behold new ramparts raised nightly, erected out of the ruins which the day had made. France had now put the sickle into her second harvest since Edward with his victorious army sat down before the town. The eyes of all Europe were intent on the issue. The English made their approaches and attacks without remission; but the citizens were as obstinate in repelling all their efforts. At length, famine did more for Edward than arms. After the citizens had devoured the lean carcases of their half-starved cattle, they tore up old foundations and rubbish in search of vermin: they fed on boiled leather, and the weeds of exhausted gardens; and a morsel of damaged corn was accounted matter of luxury.

Rapin's Hist. Eng. Edw. III.

Patriotism. luxury. In this extremity they resolved to attempt the enemy's camp. They boldly sallied forth; the English joined battle; and, after a long and desperate engagement, Count Vienne was taken prisoner; and the citizens, who survived the slaughter, retired within their gates. On the captivity of their governor, the command devolved upon Eustace Saint Pierre, the mayor of the town, a man of mean birth, but of exalted virtue. Eustace soon found himself under the necessity of capitulating, and offered to deliver to Edward the city, with all the possessions and wealth of the inhabitants, provided he permitted them to depart with life and liberty. As Edward had long since expected to ascend the throne of France, he was exasperated to the last degree against these people, whose sole valour had defeated his warmest hopes; he therefore determined to take an exemplary revenge, though he wished to avoid the imputation of cruelty. He answered by Sir Walter Mauny, that they all deserved capital punishment, as obstinate traitors to him, their true and notable sovereign; that, however, in his wonted clemency, he consented to pardon the bulk of the plebeians, provided they would deliver up to him six of their principal citizens with halters about their necks, as victims of due atonement for that spirit of rebellion with which they had inflamed the common people. All the remains of this desolate city were convened in the great square; and like men arraigned at a tribunal from whence there was no appeal, expected with throbbing hearts the sentence of their conqueror. When Sir Walter had declared his message, consternation and pale dismay was impressed on every face: each looked upon death as his own inevitable lot; for how should they desire to be saved at the price proposed? Whom had they to deliver up, save parents, brothers, kindred, or valiant neighbours, who had so often exposed their lives in their defence? To a long and dead silence, deep sighs and groans succeeded, till Eustace Saint Pierre ascending a little eminence, thus addressed the assembly: "My friends and fellow-citizens, you see the condition to which we are reduced; we must either submit to the terms of our cruel and ensnaring conqueror, or yield up our tender infants, our wives, and chaste daughters, to the bloody and brutal lusts of the violating soldiery. We well know what the tyrant intends by his specious offers of mercy. It does not satiate his vengeance to make us merely miserable, he would also make us criminal: he would make us contemptible: he will grant us life on no condition, save that of our being unworthy of it. Look about you, my friends, and fix your eyes on the persons whom you wish to deliver up as the victims of your own safety. Which of these would you appoint to the rack, the axe, or the halter? Is there any here who has not watched for you, who has not fought for you, who has not bled for you? Who, through the length of this inveterate siege, has not suffered fatigues and miseries a thousand times worse than death, that you and yours might survive to days of peace and prosperity? Is it your preservers, then, whom you would destine to destruction? You will not, you cannot, do it. Justice, honour, humanity, make such a treason impossible. Where then is our resource? Is there any expedient left, whereby we may avoid guilt and infamy on the one hand, or the desolation and horrors of a sacked city on the other? There is, my friends, there is one expedient left; a gracious, an e cellent, a god-like expedient! Is there any here whom virtue is dearer than life! Let him offer hi self an oblation for the safety of his people! he sha not fail of a blessed approbation from that power, wl offered up his only Son for the salvation of mankind. He spoke—but an universal silence ensued. Each m looked round for the example of that virtue and ma nanimity in others, which all wished to approve themselves, though they wanted the resolution. length Saint Pierre resumed: "It had been base me, my fellow-citizens, to promote any matter of d mage to others, which I myself had not been willi to undergo in my own person. But I held it ung nerous to deprive any man of that preference and est mation, which might attend a first offer on so sign an occasion: for I doubt not but there are many he as ready, nay, more zealous for this martyrdom than can be, however modesty and the fear of imputed oste tation may withhold them from being foremost in e hibiting their merits. Indeed the station to whi the captivity of Count Vienne has unhappily raised m imports a right to be the first in giving my life f your sakes. I give it freely, I give it cheerfully. W comes next? Your son! exclaimed a youth, not y come to maturity.—Ah, my child! cried St Pierre; am then twice sacrificed.—But no—I have rather b gotten thee a second time.—Thy years are few, but fu my son; the victim of virtue has reached the utmo purpose and goal of mortality. Who next, my friends This is the hour of heroes.—Your kinsman, cri John de Aire! Your kinsman, cried James Wissant Your kinsman, cried Peter Wissant!—"Ah! (exclai ed Sir Walter Mauny, bursting into tears), why was not a citizen of Calais?" The sixth victim was sti wanting, but was quickly supplied by lot, from nun bers who were now emulous of so ennobling an exampl The keys of the city were then delivered to Sir Walte He took the six prisoners into his custody. He ordere the gates to be opened, and gave charge to his atten ants to conduct the remaining citizens with their fam lies through the camp of the English. Before they departed, however, they desired permission to take the last adieu of their deliverers.—What a parting! what scene! they crowded with their wives and children abo St Pierre and his fellow-prisoners. They embrace they clung around, they fell prostrate before then They groaned; they wept aloud; and the joint cl mour of their mourning passed the gates of the cit and was heard throughout the camp. At length Sai Pierre and his fellow-victims appeared under the conduct of Sir Walter and his guard. All the tents the English were instantly emptied. The soldier poured from all parts, and arranged themselves o each side to behold, to contemplate, to admire th little band of patriots as they passed. They murmu ed their applause of that virtue which they could no but revere even in enemies; and they regarded thos ropes which they had voluntarily assumed about thei necks as ensigns of greater dignity than that of th British Garter. As soon as they had reached th royal presence, "Mauny (says the king), are these th principal inhabitants of Calais?" "They are (say Mauny); they are not only the principal men of Calais, they are the principal men of France, my lord if virtue has any share in the act of ennobling." "Were they delivered peaceably, (says Edward)? Was there no resistance, no commotion among the people!" "Not in the least, my lord. They are self-delivered, self-devoted, and come to offer up their inestimable heads as an ample equivalent for the ransom of thousands."

The king, who was highly incensed at the length and difficulty of the siege, ordered them to be carried away to immediate execution; nor could all the remonstrances and intreaties of his courtiers divert him from his cruel purpose. But what neither a regard to his own interest and honour, what neither the dictates of justice, nor the feelings of humanity, could effect, was happily accomplished by the more powerful influence of conjugal affection. The queen, who was then big with child, being informed of the particulars respecting the six victims, flew into her husband's presence, threw herself on her knees before him, and, with tears in her eyes, besought him not to stain his character with an indelible mark of infamy, by committing such a horrid and barbarous deed. Edward could refuse nothing to a wife whom he so tenderly loved, and especially in her condition; and the queen, not satisfied with having saved the lives of the six burghers, conducted them to her tent, where she applauded their virtue, regaled them with a plentiful repast, and having made them a present of money and clothes, sent them back to their fellow citizens.

The love of their country, and of the public good, seems to have been the predominant passion of the Spartans. Pedaretus having missed the honour of being chosen one of the three hundred who had a certain rank of distinction in the city, went home extremely pleased and satisfied; saying, "He was overjoyed there were three hundred men in Sparta more honourable than himself."

Plutarch's Life of Lycurgus.

The patriotism of the Romans is well known, and has been justly admired. We shall content ourselves at present with the following example; a zeal and patriotic devotion similar to which is perhaps scarcely equalled, and certainly is not exceeded, in history.

Dion. lib. viii. p. 570. and Rollin's Rom. Hist. vol. i. p. 366.

Rome, under the consuls Cæso Fabius and T. Virginius, had several wars to sustain, less dangerous than troublesome, against the Æqui, Volsci, and Veientes. To put a stop to the incursions of the last, it would have been necessary to have established a good garrison upon their frontiers to keep them in awe. But the commonwealth, exhausted of money, and menaced by abundance of other enemies, was not in a condition to provide for so many different cares and expences. The family of the Fabii showed a generosity and love of their country that has been the admiration of all ages. They applied to the senate, and by the mouth of the consul demanded as a favour that they would be pleased to transfer the care and expences of the garrison necessary to oppose the enterprises of the Veientes to their house, which required an assiduous rather than a numerous body, promising to support with dignity the honour of the Roman name in that post. Every body was charmed with so noble and unheard of an offer; and it was accepted with great acknowledgment. The news spread over the whole city, and nothing was talked of but the Fabii. Every body praised, every body admired and extolled them to the skies. "If there were two more such families in Rome," said they, "the one might take upon them the war against the Volsci, and the other against the Æqui, whilst the commonwealth remained quiet, and the forces of particulars subdued the neighbouring states."

Early the next day the Fabii set out, with the consul at their head, robed, and with his insignia. Never was there so small, and at the same time so illustrious, an army seen; for which we have the authority of Livy. Three hundred and six soldiers, all patricians, and of the same family, of whom not one but might be judged worthy of commanding an army, march against the Veii full of courage and alacrity, under a captain of their own name, Fabius. They were followed by a body of their friends and clients, animated by the same spirit and zeal, and actuated only by great and noble views. The whole city flocked to see so fine a sight; praised those generous soldiers in the highest terms; and promised them consulships, triumphs, and the most glorious rewards. As they passed before the capitol and the other temples, every body implored the gods to take them into their protection; to favour their departure and undertaking, and to afford them a speedy and happy return. But those prayers were not heard. When they arrived near the river Cremera, which is not far from Veii, they built a fort upon a very rough and steep mountain for the security of the troops, which they surrounded with a double fosse, and flanked with several towers. This settlement, which prevented the enemy from cultivating their ground and ruined their commerce with strangers, incommoded them extremely. The Veientes not finding themselves strong enough to ruin the fort which the Romans had erected, applied to the Hetrurians, who sent them very considerable aid. In the mean time the Fabii, encouraged by the great success of their incursions into the enemy's country, made farther progress every day. Their excessive boldness made the Hetrurians conceive thoughts of laying ambuscades for them in several places. During the night they seized all the eminences that commanded the plain, and found means to conceal a great number of troops upon them. The next day they dispersed more cattle about the country than they had done before. The Fabii being apprised that the plains were covered with flocks and herds, and defended by only a very small number of troops, they quitted their fort, leaving in it only a sufficient number to guard it. The hopes of a great booty quickened their march. They arrived at the place in order of battle; and were preparing to attack the advanced guard of the enemy, when the latter, who had their orders, fled without staying till they were charged. The Fabii, believing themselves secure, seized the shepherds, and were preparing to drive away the cattle. The Hetrurians then quitted their skulking places, and fell upon the Romans from all sides, who were most of them dispersed in pursuit of their prey. All they could do was to rally immediately; and that they could not effect without great difficulty. They soon saw themselves surrounded on all sides, and fought like lions, selling their lives very dear. But finding that they could not sustain this kind of combat long, they drew up in a wedge, and advancing with the utmost fury and impetuosity, opened themselves a passage through the enemy that led to the side of the mountain. When they came thither, they halted, and fought with fresh courage, the enemy leaving them no time to respire. As they were upon the higher ground, they defended themselves with advantage, notwithstanding their small number; and beating down the enemy, who spared no pains in the attack, they made a great slaughter of them. But the Veientes having gained the top of the mountain by taking a compass, fell suddenly upon them, and galled them exceedingly from above with a continual shower of darts. The Fabii defended themselves to their last breath, and were all killed to a man. The Roman people were highly affected with the loss of this illustrious band of patriots. The day of their defeat was ranked amongst the unfortunate days, called *nefasti*, on which the tribunals were shut up, and no public affair could be negociated, or at least concluded. The memory of these public-spirited patricians, who had so generously sacrificed their lives and fortunes for the service of the state, could not be too much honoured.

PATRIPASSIANS, Patripassiani, in church history, a Christian sect, who appeared about the latter end of the second century; so called from their ascribing the passion to the Father; for they asserted the unity of God in such a manner as to destroy all distinctions of persons, and to make the Father and Son precisely the same; in which they were followed by the Sabellians and others. The author and head of the Patripassians was Praxeas, a philosopher of Phrygia in Asia. Swedenbourg and his followers seem to hold the same faith.

PATROCLUS, a Grecian chief at the Trojan war. He was the son of Menœtius, by Sthenele, whom some call *Philomela* or *Polymela*. The murder of Clysonymus, the son of Amphidamas, by accident, in the time of his youth, made him fly from Opus, where his father reigned. He went to the court of Peleus king of Phthia. He was cordially received, and contracted the most intimate friendship with Achilles the king's son. When the Greeks went to the Trojan war, Patroclus went with them at the express desire of his father, who had visited the court of Peleus; and he accordingly embarked with ten ships from Phthia. He was the constant companion of Achilles; lodged in the same tent; and, when he refused to appear in the field of battle, because he had been offended by Agamemnon, Patroclus imitated his example, and by his absence was the cause of much evil to the Greeks. At last, however, Nestor prevailed upon him to return to the war, and Achilles permitted him to appear in his armour. The bravery of Patroclus, together with the terror which the sight of the arms of Achilles inspired, soon routed the victorious armies of the Trojans, and obliged them to fly to the city for safety. He would have broken down the walls; but Apollo, who interested himself for the Trojans, opposed him; and Hector, at the instigation of that god, dismounted from his chariot to attack him as he attempted to strip one of the Trojans whom he had slain. This engagement was obstinate; but Patroclus was at length overpowered by the valour of Hector, and the interposition of Apollo. His arms became the property of the conqueror; and Hector would have severed his head from his body had not Ajax and Menelaus prevented it. His body was at last recovered, and carried to the Grecian camp, where Achilles received it with the
loudest lamentations. His funerals were observed v
the greatest solemnity. Achilles sacrificed near
burning pile twelve young Trojans, four of his hor
and two of his dogs; and the whole was conclu
by the exhibition of funeral games, in which the c
querors were liberally rewarded by Achilles.
death of Patroclus, as described by Homer, gave
to new events. Achilles forgot his resentment aga
Agamemnon, and entered the field to avenge
fall of his friend; and his anger was gratified o
by the slaughter of Hector, who had more powerf
kindled his wrath by appearing at the head of the T
jan armies in the armour which had been taken fr
the body of Patroclus. The patronymic of Actori
is often applied to Patroclus, because Actor was fat
to Menœtius.

PATROL, in war, a round or march made by
guards or watch in the night time, to observe w
passes in the streets, and to secure the peace and tr
quillity of a city or camp. The patrol generally c
sists of a body of five or six men, detached from a b
on guard, and commanded by a serjeant.

They go every hour of the night, from the beat
of the tattoo until the reveille: they are to walk in
streets in garrisons, and all over the camp in the fi
to prevent disorders, or any number of people from
sembling together: they are to see the lights in the s
diers barracks put out, and to take up all the soldi
they find out of their quarters. Sometimes patrols c
sist of an officer and 30 or 40 men, as well infantry
cavalry; but then the enemy is generally near at ha
and consequently the danger the greater.

PATRON, among the Romans, was an appellati
given to a master who had freed his slave. As soon
the relation of master expired, that of patron bega
for the Romans, in giving their slaves their freedo
did not despoil themselves of all rights and privile
in them; the law still subjected them to considera
services and duties towards their patrons, the neglect
which was very severely punished.

Patron was also a name which the people of Ro
gave to some great man, under whose protection th
usually put themselves; paying him all kinds of hon
and respect, and denominating themselves his client
while the patron, on his side, granted them his cre
and protection. They were therefore mutually atta
ed and mutually obliged to each other; and by t
means, in consequence of reciprocal ties, all those se
tions, jealousies, and animosities, which are someti
the effect of a difference of rank, were prudently
voided: for it was the duty of the patron to advise
clients in points of law, to manage their suits, to ta
care of them as of his own children, and secure th
peace and happiness. The clients were to assist th
patrons with money on several occasions; to rans
them or their children when taken in war; to cont
bute to the portions of their daughters; and to defra
in part, the charges of their public employments. Th
were never to accuse each other, or take contrary sid
and if either of them was convicted of having violat
this law, the crime was equal to that of treason, a
any one was allowed to kill the offender with impuni
This patronage was a tie as effectual as any consang
nity or alliance, and had a wonderful effect towa
maintaining union and concord among the people

the space of 600 years; during which time we find no dissensions or jealousies between the patrons and their clients, even in the times of the republic, when the populace frequently mutinied against those who were most powerful in the city.

Patron, in the church of Rome, a saint whose name a person bears, or under whose protection he is put, and whom he takes particular care to invoke; or a saint in whose name a church or order is founded.

Patron, in the canon or common law, is a person who, having the advowson of a parsonage, vicarage, or the like spiritual promotion, belonging to his manor, hath on that account the gift and disposition of the benefice, and may present to it whenever it becomes vacant. The patron's right of disposing of a benefice originally arises either from the patron or his ancestors, &c. being the founders or builders of the church; from their having given lands for the maintenance thereof; or from the church's being built on their ground; and frequently from all three together.

PATRONAGE, or **Advowson**, a sort of incorporeal hereditament, consisting in the right of presentation to a church or ecclesiastical benefice. Advowson, *advocatio*, signifies *in clientelam recipere*, the taking into protection; and therefore is synonymous with patronage, *patronatus*: and he who has the right of advowson is called the *patron of the church*. For when lords of manors first built churches on their own demesnes, and appointed the tithes of those manors to be paid to the officiating ministers, which before were given to the clergy in common (from whence arose the division of parishes), the lord who thus built a church, and endowed it with a glebe or land, had of common right a power annexed of nominating such minister as he pleased (provided he were canonically qualified) to officiate in that church, of which he was the founder, endower, maintainer, or, in one word, the patron.

Blackst. Comment.

Advowsons are either advowsons *appendant*, or advowsons *in gross*. Lords of manors being originally the only founders, and of course the only patrons, of churches, the right of patronage or presentation, so long as it continues annexed to the possession of the manor, as some have done from the foundation of the church to this day, is called an *advowson appendant*: and it will pass, or be conveyed, together with the manor, as incident and appendant thereto, by a grant of the manor only, without adding any other words. But where the property of the advowson has been once separated from the property of the manor by legal conveyance, it is called an *advowson in gross*, or at large, and never can be appendant any more; but it is for the future annexed to the person of its owner, and not to his manor or lands.

Advowsons are also either *presentative*, *collative*, or *donative*. An advowson presentative, is where the patron hath a right of presentation to the bishop or ordinary, and moreover to demand of him to institute his clerk if he finds him canonically qualified: and this is the most usual advowson. An advowson collative, is where the bishop and patron are one and the same person: in which case the bishop cannot present to himself; but he does, by the one act of collation, or conferring the benefice, the whole that is done in common cases, by both presentation and institution. An advowson donative, is when the king, or any subject by his licence, doth found a church or chapel, and ordains that it shall be merely in the gift or disposal of the patron; subject to his visitation only, and not to that of the ordinary; and vested absolutely in the clerk by the patron's deed of donation, without presentation, institution, or induction. This is said to have been anciently the only way of conferring ecclesiastical benefices in England; the method of institution by the bishop not being established more early than the time of Archbishop Becket in the reign of Henry II. and therefore, though Pope Alexander III. in a letter to Becket, severely inveighs against the *prava consuetudo*, as he calls it, of investiture conferred by the patron only, this however shows what was then the common usage. Others contend that the claim of the bishops to institution is as old as the first planting of Christianity in this island; and in proof of it they allege a letter from the English nobility to the pope in the reign of Henry the Third, recorded by Matthew Paris, which speaks of presentation to the bishop as a thing immemorial. The truth seems to be, that, where the benefice was to be conferred on a mere layman, he was first presented to the bishop in order to receive ordination, who was at liberty to examine and refuse him: but where the clerk was already in orders, the living was usually vested in him by the sole donation of the patron; till about the middle of the 12th century, when the pope and his bishops endeavoured to introduce a kind of feodal dominion over ecclesiastical benefices, and, in consequence of that, began to claim and exercise the right of institution universally, as a species of spiritual investiture.

However this may be, if, as the law now stands, the true patron once waves this privilege of donation, and presents to the bishop, and his clerk is admitted and instituted, the advowson is now become for every presentative, and shall never be donative any more. For these exceptions to general rules and common right are ever looked upon by the law in an unfavourable view, and construed as strictly as possible. If therefore the patron, in whom such peculiar right resides, does once give up that right, the law, which loves uniformity, will interpret it to be done with an intention of giving it up for ever; and will therefore reduce it to the standard of other ecclesiastical livings. See further, Law, Part III. Sect. v. N° clix. 5—10.

Arms of Patronage, in *Heraldry*, are those on the top of which are some marks of subjection and dependence: thus the city of Paris lately bore the fleurs-de-lis in chief, to show her subjection to the king; and the cardinals, on the top of their arms, bear those of the pope, who gave them the hat, to show that they are his creatures.

PATRONYMIC, among grammarians, is applied to such names of men or women as are derived from those of parents or ancestors.

Patronymics are derived, 1. From the father; as Pelides, *i. e.* Achilles the son of Peleus. 2. From the mother; as Philyrides, *i. e.* Chiron the son of Philyra. 3. From the grandfather on the father's side; as Æacides, *i. e.* Achilles the grandson of Æacus. 4. From the grandfather by the mother's side; as Atlantiades, *i. e.* Mercury the grandson of Atlas. And, 5. From the kings and founders of nations; as Romulidæ, *i. e.* the Romans, from their founder King Romulus.

The terminations of Greek and Latin patronymics are chiefly four, viz. *des*, of which we have examples above; *as*, as Thaumantias, *i. e.* Iris the daughter of Thaumas; *is*, as Atlantis, *i. e.* Electra the daughter of Atlas; and *ne*, as Nerine, the daughter of Nereus. Of these terminations *des* is masculine; and *as*, *is*, and *ne*, feminine; *des* and *ne* are of the first declension, *as* and *is* of the third.

The Rusians, in their usual mode of address, never prefix any title or appellation of respect to their names; but persons of all ranks, even those of the first distinction, call each other by their Christian names, to which they add a patronymic. These patronymics are formed in some cases by adding Vitch (the same as our Fitz, as Fitzherbert, or the son of Herbert) to the Christian name of the father; in others by Of or Ef; the former is applied only to persons of condition, the latter to those of inferior rank. Thus,

Ivan Ivanovitch, Ivan Ivanof, is Ivan the son of Ivan: Peter Alexievitch, Peter Alexeof, Peter the son of Alexey.

The female patronymic is Efna or Ofna, as Sophia Alexeefna, or Sophia the daughter of Alexey; Maria Ivanofna, or Maria the daughter of Ivan.

Great families are also in general distinguished by a surname, as those of Romanof, Galitzin, Sheremetof, &c.

PATROS, mentioned by Jeremiah and Ezekiel, appears from the context to be meant of a part of Egypt. Bocchart thinks it denotes the Higher Egypt; the Septuagint translate it the country of *Pathure;* in Pliny we have the *Nomos Pathurites* in the Thebais; in Ptolemy, *Pathyris*, probably the metropolis. From the Hebrew appellation *Patros* comes the gentilitious name *Pathrusim*, (Moses).

PATTANS, Patans, or Afghans, a very warlike race of men, who had been subjects of the vast empire of Bochara. They revolted under their governor Abstagi, in the 10th century, and laid the foundation of the empire of Ghizni or Gazna. In the Dissertation prefixed to vol. iii. of Dow's History, we have this account of the Pattans.

"They are divided into distinct communities, each of which is governed by a prince, who is considered by his subjects as the chief of their blood, as well as their sovereign. They obey him without reluctance, as they derive credit to their family by his greatness. They attend him in his wars with the attachment which children have to a parent; and his government, though severe, partakes more of the rigid discipline of a general than the caprice of a despot. Rude, like the face of their country, and fierce and wild as the storms which cover their mountains, they are addicted to incursions and depredations, and delight in battle and in plunder. United firmly to their friends in war, to their enemies faithless and cruel, they place justice in force, and conceal treachery under the name of address."

The empire, which took its rise from the revolt of the Pattans, under a succession of warlike princes rose to a surprising magnitude. In the beginning of the 11th century, it extended from Ispahan to Bengal, and from the mouths of the Indus to the banks of the Jaxartes, which comprehends at least half of the continent of Asia. They had fled to the mountains on the borders of Persia, that they might escape the sword, or avoid submitting to the conquerors of India; and there they formed their state, which the Moguls were never able thoroughly to subdue. Indeed they sometimes exercised depredations on the adjacent countries; nor was it possible for the Moguls either to prevent it or to extirpate them. They were sensible that the climate and soil of the delicious plains would only serve to rob them of that hardiness they contracted in the hills to which they were confined; they, therefore, for a long time gave no indications of a desire to exchange them for more pleasing abodes, or a more accessible situation. This enabled them to brave the victorious army of Nadir Shah, whose troops they quietly suffered to penetrate into Hindostan, and waited his return with the spoils of that country.—They then harassed his army in the straits and defiles of the mountains, and proved themselves such absolute masters of the passes, that they forced him to purchase from them his passage into Persia.

In the beginning of the 18th century, they had spread themselves over the adjoining province of Kandahar; and such was the imbecility of the Persian empire at that time, that many other provinces and tributary states were also induced to revolt. When the king or shah of that time, whose name was *Hussein*, opposed the growing power of this warlike people, he was totally defeated, and Ispahan was besieged and obliged to surrender, after having suffered dreadful calamities, to an army consisting of only 30,000 men. In consequence of this, they brought about a revolution in Persia, and subjected it to themselves. This sovereignty, however, they only held for seven years and 21 days, having fallen a sacrifice to the enterprising spirit of Kouli Khan, or Nadir Shah. See Persia and Afghans.

PAU, a town of France, in the department of Low Pyrenees, having formerly a parliament, a mint, and a castle. "The city of Pau (says Wraxal *) will be for ever memorable in history, since it was the birthplace of Henry IV. That immortal prince was born in the castle, then the usual residence of the kings of Navarre. It stands on one of the most romantic and singular spots I have ever seen, at the west end of the town, upon the brow of a rock which terminates perpendicularly. Below runs the Gave, a river or rather a torrent which rises in the Pyrenees, and empties itself into the Adour. On the other side, about two miles off, is a ridge of hills covered with vineyards, which produce the famous *Vin de Jorençon*, so much admired; and beyond all, at the distance of nine leagues, appear the Pyrenees themselves, covering the horizon from east to west, and bounding the prospect. The castle, though now in a state of decay, is still habitable; and the apartments are hung with tapestry, said to be the work of Jane queen of Navarre, and mother of Henry IV. Gaston IV. count de Foix, who married Leonora heiress of the crown of Navarre, began the edifice in 1464; but his successor Henry d'Albret completed and enlarged it about the year 1519, when he made choice of the city of Pau for his residence, and where, during the remainder of his reign, he held his little court. In a chamber, which by its size was formerly a room of state, is a fine whole-length portrait of that Jane queen of Navarre whom I have just mentioned. Her dress is very splendid, and resembles those in which our Elizabeth is usually painted. Her head-dress is adorned with pearls; round her neck she wears a ruff; and her arms, which are likewise covered with pearls, are concealed by her habit quite down to the wrist. At her waist hangs by a chain a miniature portrait. The fingers of her right hand play on the strings of a guitar; and in her left she holds an embroidered handkerchief. The painter has drawn her as young, yet not in the first bloom of youth. Her features are regular, her countenance thin, but rather inclining to long; the eyes hazel, and the eyebrows finely arched. Her nose is well formed, though large, and her mouth pretty. She was a great princess, of high spirit, and undaunted magnanimity. Her memory is not revered by the French historians, because she was the protectress of the Huguenots and the friend of Coligni; but the actions of her life evince her distinguished merit.

"In one of the adjoining chambers, is another portrait of Henry IV. himself when a boy; and on the second floor is the apartment in which he was born. The particulars of his birth, are in themselves so curious, and and as relating to so great and good a prince, are so peculiarly interesting, that I doubt not you will forgive my enumerating them, even though you should have seen them elsewhere.—His mother Jane had already lost two sons, the duke de Beaumont and the count de Marle. Henry d'Albret, her father, anxious to see an heir to his dominions, enjoined her (when she accompanied her husband Anthony of Bourbon to the wars of Picardy against the Spaniards), if she proved with child, to return to Pau, and to lie in there, as he would himself superintend the education of the infant from the moment of its birth. He threatened to disinherit her if she failed to comply with this injunction. The princess, in obedience to the king's command, being in the ninth month of her pregnancy, quitted Compiegne in the end of November, traversed all France in 15 days, and arrived at Pau, where she was delivered of a son on the 13th December 1553. She had always been desirous to see her father's will, which he kept in a golden box; and he promised to show it to her, provided she admitted of his being present at her delivery, and would, during the pains of her labour, sing a song in the Bearnois language. Jane had courage enough to perform this unusual request; and the king being called on the first news of her illness, she immediately sung a Bearnois song, beginning, 'Notre Dame du bout du pont, aidez moi en cette heure.'—As she finished it, * Henry was born. The king instantly performed his promise, by giving her the box, together with a golden chain, which he tied about her neck; and taking the infant into his own apartment, began by making him swallow some drops of wine, and rubbing his lips with a root of garlic. They still show a tortoise-shell which served him for a cradle, and is preserved on that account. Several of the ancient sovereigns of Navarre resided and died in the castle of Pau. François Phœbus, who ascended the throne in 1479, died here in 1483."

* See Hen. IV. King of France.

Pau is a handsome city, well built, and contained 8585 inhabitants in 1800. It is a modern place, having owed its existence entirely to the castle, and to the residence of the kings of Navarre. W. Long. 0. 4. N. Lat. 43. 15.

PAVAN, or **Pavane**, a grave dance used among the Spaniards, and borrowed from them; wherein the performers made a kind of wheel or tail before each other, like that of *pavo*, "a peacock;" from whence the name is derived. The pavane was formerly in great repute; and was danced by gentlemen with cap and sword; by those of the long robe in their gowns, by princes with their mantles, and by the ladies with their gown tails trailing on the ground. It was called the *grand ball*, from the solemnity with which it was performed. To moderate its gravity, it was usual to introduce several flourishes, passades, capers, &c. by way of episodes. Its tablature or score is given at large by Thoinot Arbeau in his Orchesographia.

PAVETTA, a genus of plants belonging to the tetrandria class; and in the natural method ranking under the 47th order, *Stellatæ*. See Botany *Index*.

PAVIA, an ancient and celebrated town of Italy, in the duchy of Milan, and capital of the Pavesan, with an university and bishop's see. It was anciently called *Ticinum*, from its situation on that river. It lies 20 miles to the southward of Milan, and contains about 30,000 inhabitants. It was formerly the capital of the Longobardic kingdom, and is still remarkable for the broadness of its streets, the beauty and richness of some of its churches, for its university founded by Charlemagne, and for several other literary institutions. The bishop's see, which was once the richest in Italy, is now dependent on the pope; and upon the whole the city is gone to decay. The few objects within it worth the public attention belong to the clergy or monks; and the church and convent of the Carthusians are inexpressibly noble, the court of the convent being one of the finest in the world. It is defended by strong walls, large ditches, good ramparts, excellent bastions, and a bridge over the river Tasin. In the centre of the town is a strong castle, where the duke of Milan was wont to reside. It was taken by the duke of Savoy in 1706; by the French in 1733; by the French and Spaniards in 1745; but retaken by the Austrians in 1746. It fell into the hands of the French in 1796, was recovered by the Austrians in 1798, but surrendered again to the French in 1800; and formed a part of the kingdom of Italy, till the peace of Paris in 1815 restored it to the Austrians. E. Long. 9. 5. N. Lat. 45. 10.

PAVILION, in *Architecture*, signifies a kind of turret, or building, usually insulated, and contained under a single roof; sometimes square, and sometimes in form of a dome: thus called from the resemblance of its roof to a tent.

Pavilions are sometimes also projecting pieces, in the front of a building, marking the middle thereof; sometimes the pavilion flanks a corner, in which case it is called *an angular pavilion*. The Louvre is flanked with four pavilions: the pavilions are usually higher than the rest of the building. There are pavilions built in gardens, commonly called *summer-houses*, *pleasure-houses*, &c. Some castles or forts consist only of a single pavilion.

Pavilion, in military affairs, signifies a tent raised on posts, to lodge under in the summer time.

Pavilion, is also sometimes applied to flags, colours, ensigns, standards, banners, &c.

Pavilion, in *Heraldry*, denotes a covering in form of a tent, which invests or wraps up the armories of divers kings and sovereigns, depending only on God and their sword.

The pavilion consists of two parts; the top, which is the chapeau, or coronet; and the curtain, which makes the mantle.

None but sovereign monarchs, according to the French heralds, may bear the pavilion entire, and in all its parts. Those who are elective, or have any dependence, say the heralds, must take off the head, and retain nothing but the curtains.

PAVILIONS, among jewellers, the undersides and corners of the brilliants, lying between the girdle and the collet.

PAVING, the construction of ground-floors, streets, or highways, in such a manner that they may be conveniently walked upon. In Britain, the pavement of the grand streets, &c. is usually of flint, or rubble-stone; courts, stables, kitchens, halls, churches, &c. are paved with tiles, bricks, flags, or fire-stone; sometimes with a kind of freestone and ragstone.

In some streets, e. g. of Venice, the pavement is of brick: churches sometimes are paved with marble, and sometimes with mosaic work, as the church of St Mark at Venice. In France, the public roads, streets, courts, &c. are all paved with gres or gritt, a kind of freestone.

In Amsterdam and the chief cities of Holland, they call their brick pavement the *burghermasters pavement*, to distinguish it from the stone or flint pavement, which usually takes up the middle of the street, and which serves for carriages; the brick which borders it being destined for the passage of people on foot.

Pavements of free-stone, flint, and flags, in streets, &c. are laid dry, i. e. in a bed of sand; those of courts, stables, ground-rooms, &c. are laid in a mortar of lime and sand; or in lime and cement, especially if there be vaults or cellars underneath. Some masons, after laying a floor dry, especially of brick, spread a thin mortar over it; sweeping it backwards and forwards to fill up the joints. The several kinds of pavement are as various as the materials of which they are composed, and whence they derive the name by which they are distinguished; as,

1. *Pebble-paving*, which is done with stones collected from the sea-beach, mostly brought from the islands of Guernsey and Jersey: they are very durable, indeed the most so of any stone used for this purpose. They are used of various sizes, but those which are from six to nine inches deep, are esteemed the most serviceable. When they are about three inches deep, they are denominated *bolders* or *bowlers;* these are used for paving court-yards, and other places not accustomed to receive carriages with heavy weights; when laid in geometrical figures, they have a very pleasing appearance.

2. *Rag-paving* was much used in London, but is very inferior to the pebbles; it is dug in the vicinity of Maidstone in Kent, from which it has the name of *Kentish ragstone;* there are squared stones of this material for paving coach tracks and footways.

3. *Purbeck pitchens;* square stones used in footways; they are brought from the island of Purbeck, and also frequently used in court-yards; they are in general from six to ten inches square, and about five inches deep.

4. *Squared paving*, for distinction by some called *Scotch paving*, because the first of the kind paved in the manner that has been and continues to be paved, came from Scotland; the first was a clear close stone, called *blue whynn*, which is now disused, because it has been found inferior to others since introduced in the order they are hereafter placed.

5. *Granite*, a hard material, brought also from land, of a reddish colour, very superior to the whynn quarry, and at present very commonly us London.

6. *Guernsey*, which is the best, and very much in it is the same stone with the pebble before spoken of broken with iron hammers, and squared to any di sions required of a prismoidical figure, set with its s est base downwards. The whole of the foregoing ing should be bedded and paved in small gravel.

7. *Purbeck paving*, for footways, is in general g large surfaces about two inches and a half thick; blue sort is the hardest and the best of this kin paving.

8. *Yorkshire paving*, is an exceeding good mate for the same purpose, and is got of almost any dimens of the same thickness as the Purbeck. This stone not admit the wet to pass through it, nor is it affe by the frost.

9. *Ryegate* or *firestone paving*, is used for hear stoves, oven, and such places as are liable to great h which does not affect the stone if kept dry.

10. *Newcastle flags*, are stones about two feet squa and one inch and a half or two inches thick; they swer very well for paving out-offices: they are so what like the Yorkshire.

11. *Portland paving*, with stone from the island Portland; this is sometimes ornamented with bla marble dots.

12. *Swedland paving*, is a black slate dug in Leic tershire, and looks well for paving halls, or in part coloured paving.

13. *Marble paving*, is mostly variegated with diff ent marbles, sometimes inlaid in mosaic.

14. *Flat brick paving*, done with brick laid in san mortar, or groute, as when liquid lime is poured in the joints.

15. *Brick-on-edge paving*, done with brick laid edg wise in the same manner.

16. Bricks are also laid flat or edgewise in herrin bone.

17. Bricks are also sometimes set endwise in san mortar, or groute.

18. Paving is also performed with paving bricks.

19. With ten inch tiles.

20. With foot tiles.

21. With clinkers for stables and outer offices.

22. With the bones of animals, for gardens, &c.

And, 23. We have knob paving, with large grave stones, for porticoes, garden-seats, &c.

Pavements of churches, &c. frequently consist of stone of several colours; chiefly black and white, and of several forms, but chiefly squares and lozenges, artfully disposed. Indeed, there needs no great variety of colour to make a surprising diversity of figures and arrangements. M. Truchet, in the Memoirs of the French Academy, has shown by the rules of combination, tha two square stones, divided diagonally into two colours may be joined together chequerwise 64 different ways which appears surprising enough; since two letters o figures can only be combined two ways.

The reason is, that letters only change their situation with regard to the first and second, the top and bottom remaining the same; but in the arrangement of these stones, each admits of four several situations, in each

whereo

whereof the other square may be changed 16 times, which gives 64 combinations.

Indeed, from a further examination of these 64 combinations, he found there were only 32 different figures, each figure being repeated twice in the same situation, though in a different combination; so that the two only differed from each other by the transposition of the dark and light parts.

PAUL, formerly named **Saul**, was of the tribe of Benjamin, a native of Tarsus in Cilicia, a Pharisee by profession; first a persecutor of the church, and afterwards a disciple of Jesus Christ, and apostle of the Gentiles It is thought he was born about two years before our Saviour, supposing that he lived 68 years, as we read in a homily which is in the 6th volume of St Chrysostom's works. He was a Roman citizen (Acts xxii. 27, 28.), because Augustus had given the freedom of the city to all the freemen of Tarsus, in consideration of their firm adherence to his interests. His parents sent him early to Jerusalem, where he studied the law at the ſeat of Gamaliel a famous doctor (id. xxii. 3.). He made very great progress in his studies, and his life was always blameless before men; being very zealous for the whole observation of the law of Moses (id. xxvi. 4, 5.). But his zeal carried him too far; he persecuted the church, and insulted Jesus Christ in his members (1 Tim. i. 13.); and when the protomartyr St Stephen was stoned, Saul was not only consenting to his death, but he even stood by and took care of the clothes of those that stoned him (Acts vii. 58, 59.). This happened in the 33d year of the common era, some time after our Saviour's death.

At the time of the persecution that was raised against the church, after the death of St Stephen, Saul was one of those that showed most violence in distressing the believers (Gal. i. 13. and Acts xxvi. 11.). He entered into their houses, and drew out by force both men and women, loaded them with chains, and sent them to prison (Acts viii. 3. and xxii. 4.). He even entered into the synagogues, where he caused those to be beaten with rods that believed in Jesus Christ, compelling them to blaspheme the name of the Lord. And having got credentials from the high-priest Caiaphas, and the elders of the Jews, to the chief Jews of Damascus, with power to bring to Jerusalem all the Christians he should find there, he went away full of threats, and breathing nothing but blood (Acts ix. 1, 2, 3, &c.). But as he was upon the road, and now drawing near to Damascus, all on a sudden about noon, he perceived a great light to come from heaven, which encompassed him and all those that were with him. This splendour threw them on the ground; and Saul heard a voice that said to him, "Saul, Saul, why persecutest thou me?" It was Jesus Christ that spoke to him. To whom Saul answered, "Who art thou, Lord?" And the Lord replied to him, "I am Jeus of Nazareth whom thou persecutest; it is hard for thee to kick against the pricks." Saul, all in consternation, asked, "Lord, what is it that thou wouldst have me do?" Jesus bid him arise and go to Damascus, where the will of the Lord should be revealed to him.

Saul then rose from the ground, and felt that he was deprived of sight; but his companions led him by the hand, and brought him to Damascus, where he continued three days blind, and without taking any nourishment. He lodged at the house of a Jew named Judas. On the third day, the Lord commanded a disciple of his, named Ananias, to go to find out Saul, to lay his hands upon him, and to cure his blindness. And as Ananias made excuses, saying that this man was one of the most violent persecutors of the church, the Lord said to him, Go and find him, because this man is an instrument that I have chosen, to carry my name before the Gentiles, before kings, and before the children of Israel; for I will show him how many things he must suffer for my name. Ananias went therefore, and found Saul, laid his hand upon him, and restored him to his sight; then rising, he was baptized, and filled with the Holy Ghost. After this he continued some days with the disciples that were at Damascus, preaching in the synagogues, and proving that Jesus was the Messiah (A).

From Damascus he went into Arabia (Gal. i. 17.), probably

(A) The conversion of such a man, at such a time, and by such means, furnishes one of the most complete proofs that have ever been given of the divine origin of our holy religion. That Saul, from being a zealous persecutor of the disciples of Christ, became all at once a disciple himself, is a fact which cannot be controverted without overturning the credit of all history. He must therefore have been converted in the miraculous manner in which he himself said he was, and of course the Christian religion be a divine revelation; or he must have been either an impostor, an enthusiast, or a dupe to the fraud of others. There is not another alternative possible.

If he was an impostor, who declared what he knew to be false, he must have been induced to act that part by some motive: (See Miracle). But the only conceivable motives for religious imposture are, the hopes of advancing one's temporal interest, credit, or power; or the prospect of gratifying some passion or appetite under the authority of the new religion. That none of these could be St Paul's motive for professing the faith of Christ crucified, is plain from the state of Judaism and Christianity at the period of his forsaking the former and embracing the latter faith. Those whom he left were the disposers of wealth, of dignity, of power, in Judea: those to whom he went were indigent men, oppressed, and kept from all means of improving their fortunes. The certain consequence therefore of his taking the part of Christianity was the loss not only of all that he possessed, but of all hopes of acquiring more; whereas, by continuing to persecute the Christians, he had hopes rising almost to a certainty of making his fortune by the favour of those who were at the head of the Jewish state, to whom nothing could so much recommend him as the zeal which he had shown in that persecution. As to credit or reputation, could the scholar of Gamaliel hope to gain either by becoming a teacher in a college of fishermen? Could he flatter himself, that the doctrines which he taught would, either in or out of Judea, do him honour, when he knew that "they were to the Jews a stumbling block, and to the Greeks foolishness?" Was it then the love of power that induced him to make this great change; Power! over whom? over a flock of sheep whom he himself had assisted to destroy, probably into the neighbourhood of Damascus, being then under the government of Aretas king of Arabia; and having remained there for a little while, he returned to Damascus, where he began again to preach the gospel. The Jews could not bear to see the progress that the gospel made here; and so resolved to put him to death: and they gained to their side the governor of Damascus, who was to apprehend him, and to deliver him to them. Of this Saul had early notice; and knowing that the gates of the city were guarded night and day to prevent him from making his escape, he was let down over the wall in a basket. And coming to Jerusalem to see Peter (Gal. i. 38.), the disciples were afraid to have any correspondence with him, not believing him to be a convert. But Barnabas having brought him to the apostles, Saul related to them the manner of his conversion, and all that had followed in consequence of it. Then he began to preach both to the Jews and Gentiles; and spoke to them with such strength of argument, that not being able to withstand him in reasoning, they resolved to kill him. For this reason, the brethren brought him to Cæsarea of Palestine, from whence he came, probably by sea, into his own country Tarsus in Cilicia.

There he continued about five or six years, from the year of Christ 37 to the year 43; when Barnabas coming to Antioch by the order of the apostles, and there having found many Christians, went to Tarsus to see Saul, and brought him with him to Antioch (Acts xi. 20, 25, 26.); where they continued together a whole year, preaching to and instructing the faithful. During this time, there happened a great famine in Judea (ib. ib. 27, 28, &c.), and the Christians of Antioch having made some collections to assist their brethren at Jerusalem, they made choice of Paul and Barnabas to go thither with their offering. They arrived there in the year of Christ 44; and having acquitted themselves of their commission, they returned again to Antioch. They had not been there long before God warned them by the prophets he had in this church, that he had appointed them to carry his word into other places. Then the church betook themselves to fasting and praying, and the prophets Simeon, Lucius, and Manaen, laid their hands on them, and sent them to preach whither the Holy Ghost should conduct them. And it was probably about this time, that is, about the year of Christ 44, that Paul being rapt up into the third heaven, saw there ineffable things, and which were above the comprehension of man (2 Cor. xii. 2, 3, 4. and Acts xiii. 4, 5, 6, &c.)

Saul and Barnabus went first into Cyprus, where they began to preach in the synagogues of the Jews. When they had gone over the whole island, they there found a Jewish magician called Bar-jesus, who was with the proconsul Sergius Paulus; and who resisted them, and endeavoured to prevent the proconsul from embracing Christianity: whereupon St Paul struck him with blindness; by which miracle the proconsul, being an eye-witness of it, was converted to the Christian faith.

From this conversion, which happened at the city of Paphos, in the year of Christ 45, many think, that the apostle first began to bear the name of *Paul*, which St Luke always gives him afterwards, as is supposed in memory of his converting Sergius Paulus. Some believe

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stroy, and whose very Shepherd had lately been murdered? Perhaps it was with the view of gratifying some licentious passion, under the authority of the new religion, that he commenced a teacher of that religion! This cannot be alleged; for his writings breathe nothing but the strictest morality, obedience to magistrates, order, and government, with the utmost abhorrence of all licentiousness, idleness, or loose behaviour, under the cloak of religion. We nowhere read in his works, that saints are above moral ordinances; that dominion is founded in grace; that monarchy is despotism which ought to be abolished; that the fortunes of the rich ought to be divided among the poor; that there is no difference in moral actions; that any impulses of the mind are to direct us against the light of our reason and the laws of nature; or any of those wicked tenets by which the peace of society has been often disturbed, and the rules of morality often broken, by men pretending to act under the sanction of divine revelation. He makes no distinctions like the impostor of Arabia in favour of himself; nor does any part of his life, either before or after his conversion to Christianity, bear any mark of a libertine disposition. As among the Jews, so among the Christians, his conversation and manners were blameless.—It has been sometimes objected to the other apostles, by those who were resolved not to credit their testimony, that having been deeply engaged with Jesus during his life, they were obliged, for the support of their own credit, and from having gone too far to return, to continue the same professions after his death; but this can by no means be said of St Paul. On the contrary, whatever force there may be in that way of reasoning, it all tends to convince us, that St Paul must *naturally* have continued a Jew, and an enemy to Christ Jesus. If *they* were engaged on one side, *he* was as strongly engaged on the other. If shame withheld them from changing sides, much more ought it to have stopped him; who, from his superior education, must have been vastly more sensible to that kind of shame than the mean and illiterate fishermen of Galilee. The only other difference was, that *they*, by quitting their Master after his death, might have preserved themselves; whereas *he*, by quitting the Jews, and taking up the cross of Christ, certainly brought on his own destruction.

As St Paul was not an impostor, so it is plain he was not an enthusiast. Heat of temper, melancholy, ignorance, and vanity, are the ingredients of which enthusiasm is composed; but from all these, except the first, the apostle appears to have been wholly free. That he had great fervour of zeal, both when a Jew and when a Christian, in maintaining what he thought to be right, cannot be denied; but he was at all times so much master of his temper, as, in matters of indifference, to "become all things to all men," with the most pliant condescension, bending his notions and manners to theirs, as far as his duty to God would permit; a conduct compatible neither with the stiffness of a bigot nor with the violent impulses of fanatical delusion. That he was not melancholy, is plain from his conduct in embracing every method which prudence could suggest to escape danger and shun persecution, lieve that he changed his name upon his own conversion; and Chrysostom will have this change to take place at his ordination, when he received his mission at Antioch; while others say, he took the name *Paul* only when he began to preach to the Gentiles: and, finally, several are of opinion, that he went by the name of both *Saul* and *Paul*, like many other Jews who had one Hebrew name and another Greek or Latin one.

From the isle of Cyprus, St Paul and his company went to Perga in Pamphylia, where John Mark left them, to return to Jerusalem: but making no stay at Perga, they came to Antioch in Pisidia; where going into the synagogue, and being desired to speak, St Paul made them a long discourse, by which he showed, that Jesus Christ was the Messiah foretold by the prophets, and declared by John the Baptist; that he had been unjustly put to death by the malice and jealousy of the Jews; and that he rose again the third day. They heard him very attentively; and he was desired to discourse again on the same subject the next Sabbath-day; and several, both Jews and Gentiles, followed them, to receive particular instructions more at leisure. On the Sabbath-day following, almost all the city met together to hear the word of God: but the Jews, seeing the concourse of people, were moved with envy at it; opposed, with blasphemies, what St Paul said; and not being able to bear the happy progress of the gospel in this country, they raised a persecution against the two apostles: whereupon Paul and Barnabas, shaking off the dust upon their feet against them, came from Antioch in Pisidia to Iconium. Being come thither, they preached in their synagogue, and converted a great number, both of Jews and Gentiles; and God confirmed their commission by a great number of miracles (Acts xiv. 1, 2, &c.). In the mean time, the unbelieving Jews, having incensed the Gentiles against Paul and Barnabas, and threatening to stone them, they were obliged to retire to Lystra and Derbe, cities of Lycaonia, where they preached the gospel. At Lystra, there was a man who had been lame from his mother's womb. This man fixing his eyes on St Paul, the apostle bid him rise, and stand upon his feet: whereupon he presently rose up, and walked; the people, seeing this miracle, cried out, that the gods were descended among them in the shape of men. They called Barnabas *Jupiter*, and Paul *Mercury*, because of his eloquence, and being the chief speaker. The priest of Jupiter brought also garlands and bulls before the gate, to offer sacrifices to them: but Paul and Barnabas tearing their clothes, and casting themselves into the middle of the multitude, cried out to them, Friends, what do you do? we are men as well as yourselves; and we are preaching to you to turn away from these vain superstitions, and to worship only the true God, who has made heaven and earth. But whatever they could say, they had much ado to restrain them from offering sacrifices to them.

In the mean time, some Jews of Antioch in Pisidia and of Iconium coming to Lystra, animated the people against the apostles. They stoned Paul, and drew him out of the city, thinking him to be dead. But the disciples gathering together about him, he rose up among them

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cution, when he could do it without betraying the duty of his office or the honour of his God. A melancholy enthusiast courts persecution; and when he cannot obtain it, afflicts himself with absurd penances: but the holiness of St Paul consisted only in the simplicity of a godly life, and in the unwearied performance of his apostolical duties. That he was ignorant, no man will allege who is not grossly ignorant himself; for he appears to have been master not only of the Jewish learning, but also of the Greek philosophy, and to have been very conversant even with the Greek poets. That he was not credulous, is plain from his having resisted the evidence of all the miracles performed on earth by Christ, as well as those that were afterward worked by the apostles; to the fame of which, as he lived in Jerusalem, he could not possibly have been a stranger. And that he was as free from vanity as any man that ever lived, may be gathered from all that we see in his writings, or know of his life. He represents himself as the least of the apostles, and not meet to be called an apostle. He says that he is the chief of sinners; and he prefers, in the strongest terms, universal benevolence to faith, and prophecy, and miracles, and all the gifts and graces with which he could be endowed. Is this the language of vanity or enthusiasm? Did ever fanatic prefer virtue to his own religious opinions, to illuminations of the spirit, and even to the merit of martyrdom?

Having thus shown that St Paul was neither an impostor nor an enthusiast, it remains only to be inquired, whether he was deceived by the fraud of others: but this inquiry needs not be long, for who was to deceive him? A few illiterate fishermen of Galilee? It was *morally* impossible for such men to conceive the thought of turning the most enlightened of their opponents, and the cruellest of their persecutors, into an apostle, and to do this by a fraud in the very instant of his greatest fury against them and their Lord. But could they have been so extravagant as to conceive such a thought, it was *physically* impossible for them to execute it in the manner in which we find his conversion to have been effected. Could they produce a light in the air, which at mid-day was brighter than the sun? Could they make Saul hear words from out of that light which were not heard by the rest of the company? Could they make him blind for three days after that vision, and then make scales fall off from his eyes, and restore him to sight by a word? Or, could they make him and those who travelled with him believe, that all these things had happened, if they had not happened? Most unquestionably no fraud was equal to all this.

Since then St Paul was neither an impostor, an enthusiast, nor deceived by the fraud of others, it follows, that his conversion was miraculous, and that the Christian religion is a divine revelation. See Lyttleton's "Observations on the Conversion of St Paul;" a treatise to which it has been truly said, that infidelity has never been able to fabricate a specious answer, and of which this note is a very short and imperfect abridgement.

them, entered again into the city, and the day after left it with Barnabas to go to Derbe. And having here preached the gospel also, they returned to Lystra, to Iconium, and to Antioch of Pisidia. Passing throughout Pisidia, they came to Pamphylia, and having preached the word of God at Perga, they went down into Attalia. From hence they set sail for Antioch in Syria, from whence they had departed a year before. Being arrived there, they assembled the church together, and told them the great things God had done by their means, and how he had opened to the Gentiles a door of salvation; and here they continued a good while with the disciples.

St Luke does not inform us of the actions of St Paul from the 45th year of Christ to the time of the council at Jerusalem, which was held in the 50th year of Christ. There is great likelihood that it was during this interval that St Paul preached the gospel from Jerusalem to Illyricum, as he informs us in his epistle to the Romans (xv. 19.); and this without making any stay in those places where others had preached before him. He does not acquaint us with the particulars of these journeys, nor with the success of his preaching; but he says in general, that he had suffered more labours than any other, and had endured more prisons. He was often very near death itself, sometimes upon the water and sometimes among thieves. He run great dangers, sometimes from the Jews and sometimes among false brethren and perverse Christians; he was exposed to great hazards, as well in the cities as in the deserts: he suffered hunger, thirst, nakedness, cold, fastings, watchings (2 Cor. xi. 23.—27.), and the fatigues inseparable from long journeys, which were undertaken without any prospect of human succour; in this very different from the good fortune of others who lived by the gospel, who received subsistence from those to whom they preached it, and who were accompanied always by religious women, who ministered to them in their necessary occasions. He made it a point of honour to preach gratis, working with his hands that he might not be chargeable to any one (1 Cor. ix. 1.—15.); for he had learned a trade, as was usual among the Jews, which trade was to make tents of leather for the use of those that go to war. (Acts xviii. 3.).

St Paul and St Barnabas were at Antioch when some persons coming from Judea (Acts xv. 1, 2, &c.) pretended to teach, that there was no salvation without circumcision, and without the observation of the other legal ceremonies. Epiphanius and Philaster say, that he that maintained this was Cerinthus and his followers. Paul and Barnabas withstood these new doctors; and it was agreed to send a deputation to the apostles and elders at Jerusalem about this question. Paul and Barnabas were deputed; and being arrived at Jerusalem, they reported to the apostles the subject of their commission. Some of the Pharisees that had embraced the faith, asserted, that the Gentiles that were converted ought to receive circumcision, and to observe the rest of the law. But the apostles and elders assembling to examine into this matter, it was by them decreed, that the Gentiles, who were converted to Christianity, should not be obliged to submit to the yoke of the law, but only to avoid idolatry, fornication, and the eating of things strangled, and blood.

St Paul and St Barnabas were then sent back to Antioch with letters from the apostles, which conta the decision of the question, and the resolution of august assembly. The apostles also deputed Jude named *Barsabas* and Silas, who were principal bret to go to Antioch with Paul and Barnabas to their testimony also of what had been decreed at J salem. Being arrived at Antioch, they assembled faithful, read to them the apostles letter, and acqu ed them, that it had been resolved to discharge t from the yoke of the ceremonial law. Some time this, St Peter coming to Antioch, and joining hin to the converted Gentiles, he lived with them wit scruple; but some brethren happening to arrive t from Jerusalem, he separated himself from the Ge converts, and did no longer eat with them: for w conduct St Paul publicly censured him (Gal. ii. 11—1 St Paul (id. ii. 2, 3, &c.) in the same journey to J salem, declared openly to the faithful there the doct he preached among the Gentiles; and besides, disc sed of it in private among the chief of them in prese of Barnabas and Titus. St Peter, St James, an John, with whom he had these conversations, could nothing to be either added or amended in so pure so sound a doctrine and demeanour. They saw with the grace that God had given him; they acknowled that he had been appointed the apostle of the Genti as St Peter had been of the circumcision. They cluded that Paul and Barnabas should continue to pre among the Gentiles; and only recommended to them take care concerning the collections for the poor; t is to say, to exhort the converted Christians among Gentiles, to assist the faithful brethren in Judea, were in necessity; whether it were because they had s and distributed their goods, or because they had b taken away from them (Heb. x. 54.).

After Paul and Barnabas had continued some days Antioch, St Paul proposed to Barnabas to return a visit the brethren through all the cities wherein th had planted the gospel, to see in what condition th were. Barnabas consented to the proposal; but insist upon taking John Mark along with them. This w opposed by Paul, which produced a separation betwe them. Barnabas and John Mark went together to C prus; and St Paul, making choice of Silas, crossed o Syria and Cilicia, and came to Derbe, and afterwa to Lystra (Acts xvi. 1, 2, &c.). Here they found disciple, called *Timothy*, whom St Paul took with hi and circumcised him that he might not offend the Je of that country. When, therefore, they had gone ov the provinces of Lycaonia, Phrygia, and Galatia, t Holy Ghost would not allow them to preach the gos in the proconsular Asia, which contained Ionia, Æoli and Lydia. They therefore went on to Mysia, a coming to Troas, St Paul had a vision in the night. man, habited like a Macedonian, presented himself b fore him, and said, Pass into Macedonia and come a succour us. Immediately he set out on this journey, n doubting but that God had called him into this cou try.

Embarking therefore at Troas, they sailed to Neap lis. Thence they came to Philippi, where upon t sabbath-day they went near the river side, where t Jews had a place of devotion, and where they foun some religious women, among whom was Lydia, w was converted and baptized, and invited the apostle an

h

his company to lodge at her house. Another day, as they went to the same place of devotion, they happened to meet a maid servant possessed with a spirit of divination, who followed St Paul and his company, crying out, that these men were the servants of the most high God, who declared to the world the way of salvation. This she did for several days together; at last St Paul, turning himself towards her, said to the spirit, I command thee in the name of Jesus Christ to come out of the body of this woman: upon which it immediately left her. But the masters of this damsel, who made much money by her, drew Paul and Silas before the magistrates, and accused them of attempting to introduce a new religion into the city. For this the magistrates ordered them to be whipt with rods upon the back and shoulders, and afterwards sent them to prison.

Towards midnight, as Paul and Silas were singing hymns and praises to God, on a sudden there was a great earthquake, so that the foundations of the prison were shaken, and all the doors flew open at the same time, and the fetters of the prisoners burst asunder. The gaoler being awakened at this noise, and seeing all the doors open, he drew his sword with an intention to kill himself, imagining that all the prisoners had made their escape. But Paul cried out to him, that he should do himself no mischief, for they were all safe. Then the gaoler entering and finding all the prisoners there, he brought out Paul and Silas from this place, asking them what he must do to be saved? Paul and Silas instructing him and all his family, gave them baptism. After this the gaoler set before them something to eat; and when the morning was come, the magistrates sent him word that he might release his prisoners, and let them go about their business. But Paul returned this answer to the magistrates; Ye have publicly whipped us with rods, being Roman citizens; ye have thrown us into prison; and now ye would privately dismiss us: But it shall not be so, for you yourselves shall come to fetch us out. The magistrates hearing that they were Roman citizens, came to excuse themselves; and having brought them out of prison, they desired them to depart out of their city. Paul and Silas went first to the house of Lydia, where having visited and comforted the brethren, they departed from Philippi.

Then passing through Amphipolis and Apollonia, they came to Thessalonica the capital city of Macedonia, where the Jews had a synagogue (Acts xvii. 1, &c.). Paul entered therein, according to his custom, and there preached the gospel to them for three Sabbath-days successively. Some Jews and several proselytes believed in Jesus Christ, and united themselves to Paul and Silas: but the greatest part of the Jews being led away by a false zeal, raised a tumult in the city, and went to the house of Jason where St Paul lodged. But not finding him there, they took Jason and led him before the magistrates, where they accused him of harbouring in his house people that were disobedient to the ordinances of the emperor, and who affirmed that there was another king besides him, one Jesus whom they preached up. But Jason having given security to answer for the people who were accused, he was dismissed to his own house; and the night following the brethren conducted Paul and Silas out of the city, who went to Berea, where they began to preach in the synagogue. The Jews of Berea heard them gladly, and many of them were converted; as also several of the Gentiles, and many women of distinction that were not Jewesses.

The Jews of Thessalonica being informed that Paul and Silas were at Berea, came thither and animated the mob against them; so that St Paul was forced to withdraw, leaving Silas and Timothy at Berea to finish the work he had so happily begun. Those who conducted St Paul embarked along with him, and brought him as far as Athens (Theod. in 1 Thessal.), where he arrived in the 52d year of Jesus Christ. As soon as he was got thither, he sent back those that had brought him, with orders to tell Silas and Timothy, that he desired them to follow him to Athens as soon as possible. In the mean time, he went into a synagogue of the Jews, and preached to them as often as he had opportunity; and disputing with the philosophers who were frequent in that place, they at last brought him before the Areopagus, accusing him of introducing a new religion. St Paul being come before the judges, pleaded in his own defence, that among other marks of superstition which he had found in that city, he had observed an altar inscribed, "To the unknown God." It was therefore this God whom they confessed that they knew not, that he came to make known to them. Afterwards he spoke to them of God the creator of heaven and earth, of the superintendence of a providence, of the last judgment, and of the resurrection of the dead. But after they had heard of the resurrection, some made scorn of him, and others desired to hear him another time. However some of them embraced the Christian faith, of which number was Dionysius a senator of the Areopagus, and a woman called *Damaris*, and several others with them.

St Timothy came from Berea to Athens according to the request of St Paul, and informed him of the persecution with which the Christians of Thessalonica were then afflicted. This obliged the apostle to send him into Macedonia, that he might comfort them and keep them stedfast (1 Thessal. iii. 1, 2, &c.). After this St Paul left Athens and went to Corinth, where he lodged with one Aquila a Jew, and by a trade a tent-maker (Acts xviii. 1, 2, &c.) With this Aquila the apostle worked, as being of the same trade himself. But, however, he did not neglect the preaching of the gospel, which he performed every day in the synagogue; showing both to the Jews and Gentiles that Jesus was the Messiah. There he made several converts: and he tells us himself (1 Cor. i. 14—17. and xvi. 15.) that he baptized Stephanus and his whole house, with Crispus and Gaius. About the same time Silas and Timothy came to Corinth, and acquainted him with the good state of the faithful at Thessalonica; and soon after this, he wrote his first epistle to the Thessalonians, which is the first of all the epistles that he wrote; and not long after he wrote his second epistle to that church.

St Paul, now finding himself encouraged by the presence of Silas and Timothy, went on with the work of his ministry with new ardour, declaring and proving that Jesus Christ was the true Messiah. But the Jews opposing him with blasphemous and opprobrious words, he shook his clothes at them, and said, "Your blood be upon your own head; from henceforth I shall go to the Gentiles." He then quitted the house of Aquila, and went to lodge with one Titus Justus, who was originally a Gentile, but one that feared God. In the mean time the Lord appeared to St Paul in a vision, told him, that in Corinth he had much people; and this was the reason why the apostle continued there eight months.

But Gallio the proconsul of Achaia being at Corinth, the Jews of that city rose up against Paul and carried him before Gallio, accusing him of attempting to introduce a new religion among them: however, Gallio sent them away, telling them he would not meddle with disputes that were foreign to his office. Paul continued some time longer at Corinth; but at last he set out for Jerusalem, where he had a mind to be present at the feast of Pentecost. Before he went on shipboard, he cut off his hair at Cenchrea, because he had completed his vow of Nazariteship, in which he had engaged himself. He arrived at Ephesus with Aquila and Priscilla, from whence he went to Cæsarea of Palestine, and thence to Jerusalem. Here having performed his devotions, he came to Antioch, where he stayed some time; and then passing from thence, he made a progress through all the churches of Galatia and Phrygia successively; and having gone over the higher provinces of Asia, he returned to Ephesus, where he abode three years; that is, from the year of Christ 57 to the year 57 (Acts xix. 1, 2, &c.).

St Paul having arrived at Ephesus, he found there some disciples that had been initiated by Apollos, who had only baptized them with the baptism of John. St Paul instructed them, baptized them with the baptism of Jesus Christ, and laid his hands on them; whereupon they received the Holy Ghost, the gifts of languages and of prophecy. The Apostle afterwards went into the synagogue, and preached to the Jews for three months, endeavouring to convince them that Jesus Christ was the Messiah: but as he found them very obstinate, he separated himself from them, and taught daily in the school of one Tyrannus. He performed there several miracles, insomuch that the linen that had but touched his body, being afterwards applied to the sick, they were presently cured of their diseases, or delivered from the devils that possessed them. He also suffered much there, as well from the Jews as from the Gentiles; and he himself informs us (1 Cor. xv. 31, 32.), that after the manner of men he fought with beasts at Ephesus; that is to say, that he was exposed to wild beasts in the amphitheatre, so that it was expected he should have been devoured by them; but God miraculously delivered him: though some are of opinion, that the fight here mentioned by St Paul was nothing else but the scuffle he had with Demetrius the silver-smith and his companions, who were disappointed in their attempt of putting the apostle to death. It was during his abode at Ephesus that the apostle wrote his epistle to the Galatians.

After this St Paul proposed, at the instigation of the Holy Ghost, to pass through Macedonia and Achaia, and afterwards to go to Jerusalem, saying, that after he had been there, he must also see Rome; and having sent Timothy and Erastus before to Macedonia, he tarried some time in Asia. During this time, he received intelligence that domestic troubles had risen in the church of Corinth, and that abuses had begun to creep in; which made him resolve to write his first epistle to that church.

Soon after this, taking leave of the disciples, h
parted for Macedonia (Acts xx. 1, 2, &c.). He
barked at Troas, took Timothy with him, and tog
passed into Macedonia (2 Cor. ii. 12. and vii. 5—
Titus came thither to him, and acquainted him wit
good effects that his letter had produced among the
rinthians; and told him, that the collections that
been made by the church of Corinth for the faithf
Palestine were now ready; which engaged Pa
write a second letter to the Corinthians. St Paul,
ving passed through Macedonia, came into Gree
Achaia, and there continued three months. He vi
the faithful of Corinth; and having received their
as he was upon the point of returning into Maced
he wrote his epistle to the Romans.

At last he left Greece and came into Macedoni
the year of Christ 58, intending to be at Jerusale
the feast of Pentecost. He staid some time at Phil
and there celebrated the feast of the passover. F
hence he embarked and came to Troas, where he
tinued a week. On the first day of the week the
ciples being assembled to break bread, as St Paul
to depart the day following, he made a discourse to t
which held till midnight. During this time a y
man called Eutychus, happening to sit in a window
fall asleep, fell down three stories high, and was ki
by the fall. St Paul came down to him, and embr
him, and restored him to life again. Then he wen
again, broke bread and ate it, and continued his
course till daybreak, at which time he departed. T
of his company took ship at Troas; but as for
self he went on foot as far as Assos, otherwise ca
Apollonia, and then embarked along with them
Mitylene. From hence he came to Miletus, whi
the elders of the church of Ephesus came to
him; for he had not time to go to them, because
was desirous of being at Jerusalem at the feast of P
tecost.

When these elders had arrived at Miletus, St P
discoursed with them, and told them that he was go
to Jerusalem without certainly knowing what sho
happen to him; however he did not doubt but that
had much to suffer there, since in all cities the H
Ghost had given him to undersand, that chains and
flictions waited for him at Jerusalem. Nevertheless,
declared to them, that all this did not terrify him, p
vided he could but fulfil his ministry. After hav
exhorted them to patience, and having prayed al
with them, he went on board, going straight to Co
then to Rhodes, and thence to Patara (Acts xxi. 1,
&c.), where finding a ship that was bound for Phœ
cia, they went on board and arrived safe at Tyre. H
they made a stop for seven days, and then going on, th
arrived at Ptolemais, and thence to Cæsarea, where th
found Philip the evangelist, who was one of the sev
deacons. While St Paul was there, the prophet Ag
bus arrived there also from Judea; and have taken
Paul's girdle, he bound his own hands and feet with
saying, "Thus shall the Jews of Jerusalem bind the m
that owns this girdle, and shall deliver him up to t
Gentiles." But St Paul's constancy was not shaken
all these predictions, and he told them that he w
ready, not only to suffer bonds, but death itself, for th
name of Christ.

When he was come to Jerusalem, the brethren r
ceive

ceived him with joy; and the day following he went to see St James the Less, bishop of Jerusalem, at whose house all the elders assembled. Paul gave them an account of what God had done among the Gentiles by his ministry. Then St James informed him, that the converted Jews were strangely prejudiced against him, because they were informed he taught the Jews that lived among the Gentiles and out of Palestine, that they ought to renounce the law of Moses, and no longer circumcise their children. Therefore, continued St James, we must assemble them here together, where you may speak to them yourself, and undeceive them. Moreover do this, that your actions may verify your words: join yourself to four men that are here, and who have taken upon them a vow of Nazariteship; and that you may share in the merit of their action, contribute to the charge of their purification, and purify yourself also, that you may offer with them the offerings and sacrifices ordained for the purification of a Nazarite. See NAZARITE.

St Paul exactly followed this advice of St James, and on the next day went into the temple, where he declared to the priests, that in seven days these four Nazarites would complete their vow of Nazariteship; and that he would contribute his share of the charges. But towards the end of these seven days, the Jews of Asia having seen him in the temple, moved all the people against him, laid hold of him, and cried out, "Help, ye Israelites, that is he that teaches every where against the law, and against the temple, and has brought Gentiles into the temple, and profaned this holy place." At the same time they laid hold on him, shut the gates of the temple, and would have killed him, had not Lysias the tribune of the Roman garrison there run to his rescue, taken him out of their hands, and brought him into the citadel. St Paul being upon the steps, desired the tribune to suffer him to speak to the people, who followed him thither in a great multitude. The tribune permitted him, and St Paul, making a sign with his hand, made a speech in Hebrew (Act xxii), and related to them the manner of his conversion, and his mission from God to go and preach to the Gentiles. At his mentioning the Gentiles, the Jews began to cry out, "Away with this wicked fellow out of the world, for he is not worthy to live."

Immediately the tribune made him come into the castle, and ordered that he should be examined by whipping him, in order to make him confess the matter why the Jews were so incensed against him. Being now bound, he said to the tribune, "Is it lawful for you to whip a Roman citizen before you hear him?" The tribune hearing this, caused him to be unbound, and calling together the priests and the senate of the Jews, he brought Paul before them, that he might know the occasion of this tumult of the people. Then Paul began to speak to them to this purpose, (Acts xxiii.): "Brethren, I have lived in all good conscience before God until this day." At which words, Ananias, son of Nebedeus, who was the chief-priest, ordered the bystanders to give him a blow in the face. At which St Paul said to him, "God shall smite thee, thou whited wall; for sittest thou to judge me after the law, and commandest me to be smitten contrary to the law?" Those that were present said to him, "Revilest thou God's high priest?" St Paul excused himself by saying, that he did not know he was the high priest, "For it is written, thou shalt not speak evil of the ruler of thy people." Then perceiving that part of the assembly were Sadducees, and part Pharisees, he cried out, "Brethren, I am a Pharisee, the son of a Pharisee; of the hope and resurrection of the dead I am called in question."

Then the assembly being divided in interests and opinions, and the clamour increasing more and more, the tribune ordered the soldiers to fetch him away out of the assembly, and bring him into the castle. The following night the Lord appeared to Paul, and said to him, "Take courage, for as you have borne testimony of me at Jerusalem, so must you also at Rome." The day following more than 40 Jews engaged themselves by an oath, not to eat or drink till they had killed Paul. They came, therefore, and made known their design to the priests and chiefs of the people, saying to them, "To-morrow cause Paul to appear before you, as if you would inquire more accurately into this affair, and before he can come to you, we will lie in wait for him and kill him." But St Paul, being informed of this conspiracy by his sister's son, acquainted the tribune with it; who gave orders that the night following he should be sent to Cæsarea, to Felix the governor, who had his ordinary residence there. Felix having received letters from Lysias, and being informed that St Paul was of Cilicia, he told him he would hear him when his accusers should arrive.

Five days after, Ananias the high-priest and some of the senators came to Cæsarea, bringing with them Tertullus the orator, to plead against Paul. Tertullus accused him of being a seditious person, a disturber of the public peace; one who had put himself at the head of a sect of Nazarenes, and who made no scruple even to profane the temple, (id. xxiv.). But St Paul easily refuted these calumnies, and defied his accusers to prove any of the articles they had exhibited against him: he ended his discourse by saying, "That for the doctrine of the resurrection from the dead, his adversaries would have him condemned." Felix put off the further hearing of this cause till another time; and, some days afterwards, came himself with his wife Drusilla to hear Paul; and being in hopes that the apostle would purchase his freedom with a sum of money, he used him well, often sent for him, and had frequent conversations with him.

Two years having thus passed away, Felix made way for his successor Portius Festus; but being willing to oblige the Jews, he left Paul in prison. Festus being come to Jerusalem, the chief priests desired to send for Paul, with a design to fall upon him by the way. But Festus told them, they might come to Cæsarea, where he would do them justice. Hither the Jews came, and accused Paul of several crimes, of which they were able to prove nothing (id. xxv.). Festus then proposed to the apostle to go to Jerusalem, and be tried there; but he answered, "That he was now at the emperor's tribunal, where he ought to be tried; and that he appealed to Cæsar:" whereupon Festus, having conferred with his council, told him, that therefore to Cæsar he should go.

Some days after, King Agrippa and his wife Berenice coming to Cæsarea, desired to hear Paul; who pleaded,

pleaded his cause with such ability, that Agrippa exclaimed, "Almost thou persuadest me to be a Christian." See AGRIPPA.

As soon, therefore, as it was resolved to send Paul into Italy, he was put on board a ship at Adramyttium, a city of Mysia; and having passed over the seas of Cilicia, and Pamphylia, they arrived at Myra, in Lycia, where, having found a ship that was bound for Italy, they went on board, (*id.* xxvii.). But the season being far advanced (for it was at least the latter end of September), and the wind proving contrary, they with much difficulty arrived at the Fair Haven, a port in the isle of Crete. St Paul advised them to winter there: however, others were of opinion they had better go to Phenice, another harbour of the same island; but as they were going thither, the wind drove them upon a little island called *Clauda*, where the mariners, fearing to strike upon some bank of sand, they lowered their mast, and surrendered themselves to the mercy of the waves. Three days after this, they threw overboard the tackling of the ship. Neither sun nor stars had appeared now for 14 days. In this extreme danger, an angel appeared to St Paul, and assured him that God had given him the lives of all that were in the ship with him; which were in all 276 souls. St Paul told them of his vision, exorted them to take courage, and promised them that they should all come alive into an island; and that the vessel only should be lost. On the 14th night the seamen cast out the lead, and thought by their sounding that they approached near to some land. They were attempting to save themselves by going into the boat; but St Paul told the centurion and the soldiers, that except the sailors continued in the ship, their lives could not be saved. Then the soldiers cut the ropes of the boat, and let her drive. About daybreak, St Paul persuaded them to take some nourishment, assuring them that not a hair of their heads should perish. After his example, they took some food, and when they had eaten, they lightened their vessel, by throwing the corn into the sea. Day being come, they perceived a shore, where they resolved, if possible, to bring the ship to. But the vessel having struck against a neck of land that run out into the sea, so that the head remained fixed, and the stern was exposed to the mercy of the waves; the soldiers, fearing lest any of the prisoners should make their escape by swimming, were for putting them all to the sword. But the centurion would not suffer them, being willing to save Paul; and he commanded those that could swim to throw themselves first out of the vessel; and the rest got planks, so that all of them came safe to shore. Then they found that the island was called *Melita* or *Malta;* the inhabitants of which received them with great humanity, (Acts xxvii. 1, 2, 3, &c.).

They being all very wet and cold, a great fire was lighted to dry them; and Paul having gathered up a handful of sticks, and put them upon the fire, a viper leaped out of the fire, and took hold of his hand. Then the barbarous people said one to another, "Without doubt this man is a murderer; and though he has been saved from the shipwreck, yet divine vengeance still pursues him and will not suffer him to live." But Paul, shaking the viper into the fire, received no injury from it. The people, seeing this, changed their opinion of him, and took him for a god; which opinion of theirs was more confirmed, by his curing father of Publius, the chief man of the island, of a fe and bloody-flux. After this miracle, they all brou out their sick to him, and they were healed. See M LITA.

At the end of three months they embarked aga and arrived, first at Syracuse, then at Rhegium, lastly at Puteoli. Here St Paul found some Christia who detained him for seven days; then he set out Rome. The brethren of this city having been infor ed of St Paul's arrival, came to meet him as far Appii forum, and the Three Taverns. And when was come to Rome, he was allowed to dwell where pleased, having a soldier to guard him, who was joi to him with a chain. Three days afterwards, St P desired the chief of the Jews there to come to him. related to them in what manner he had been seized the temple of Jerusalem, and the necessity he under of appealing to Cæsar. The Jews told him, tl as yet they had received no information about his fair; and, as for Christianity, they knew nothing it, but only that it was spoken against everywher however, that they should be very willing to have so account of that doctrine from him. A day was pointed for this purpose; when St Paul preached them concerning the kingdom of God, endeavouri to convince them from Moses and the prophets, tl Jesus was the Messiah. Some of them believed wl he had said to them, while others disbelieved; that they returned from him divided among the selves.

Paul dwelt for two whole years at Rome, from t year of Christ 61 to the year 63, in a lodging that hired; where he received all that came to him, preac ing the kingdom of God, and the religion of Jes Christ, without any interruption.

Hitherto we have had the Acts of the Apostles f our guide, in compiling the history of St Paul; what shall add hereafter, will be mostly taken from his ov Epistles. His captivity did not a little contribute the advancement of religion; for he converted sever persons even of the emperor's court, (Philip. i. 12—1 and iv. 22.). The Christians of Philippi, in Maced nia, hearing that St Paul was a prisoner at Rom sent Epaphroditus their bishop to him, to bring hi money, and otherwise to assist him in their nam (Phil. ii. 25.) Epaphroditus fell sick at Rome; an when he went back to Macedonia, the apostle sent b him his Epistle to the Philippians.

It is not known by what means St Paul was deliver ed from his prison, and discharged from the accusatio of the Jews. There is great probability that they durs not appear against him before the emperor, as not having sufficient proof of what they laid to his charge However that may be, it is certain that he was set a liberty, after having been two years a prisoner at Rome He wrote also, during this imprisonment, his Epistles t Philemon and the Colossians.

He was still in the city of Rome, or at least in Italy when he wrote his Epistle to the Hebrews. St Paul having got out of prison, went over Italy; and, according to some of the fathers, passed into Spain; then into Judea; went to Ephesus, and there left Timothy (Heb xiii. 24. and 1 Tim. i. 3.); preached in Crete, and there fixed Titus, to take care to cultivate the church he had planted in that place. Probably he might also visit the Philippians, according to the promise he had made them, (Phil. i. 23. 26. and ii. 24.); and it is believed, that it was from Macedonia that he wrote the First Epistle to Timothy.—Some time after, he wrote to Titus, whom he had left in Crete; he desires him to come to Nicopolis, from whence, probably, he sent this letter. The year following, that is, the 65th year of the Christian era, the apostle went into Asia, and came to Troas, (2 Tim. iv. 13.). Thence he went to visit Timothy at Ephesus, and from that to Miletus, (2 Tim. iv. 20.) Lastly, he went to Rome; and St Chrysostom says, that it was reported, that having converted a cupbearer and a concubine of Nero, this so provoked the emperor, that he caused St Paul to be apprehended, and clapped into prison. It was in this last place of confinement that he wrote his Second Epistle to Timothy, which Chrysostom looks upon as the apostle's last testament. See TIMOTHY and TITUS.

This great apostle at last consummated his martyrdom, the 29th of June, in the 66th year of Jesus Christ, by having his head cut off, at a place called the *Salvian Waters*. He was buried on the way of Ostium, and a magnificent church was built over his tomb, which is in being to this day. *Calmet's Dict.* &c.

PAUL, *St, Cave or Grotto of*, in the island of Malta, where St Paul and his company took shelter from the rains, when the viper fastened on his arm. Upon this spot there is a church built by the famed Alof de Vignacourt, grand-master of the order, in the year 1606, a very handsome, though but a small, structure. On the altar-piece is a curious painting, representing the apostle's shaking off the viper, surrounded with men, women, and children, in attitudes of admiration and surprise, and in the old Maltese garb; and the whole very well executed. On the top of the painting is the following inscription:

> Vipera ignis acta calore frustra Pauli
> Manum invadit; is insulæ benedicens
> Anguibus et herbis adimit omne virus.
> M.DC.V.

PAUL, first bishop of Narbonne, or Sergius Paulus the proconsul, converted and made bishop by St Paul, was descended from one of the best families of Rome. It is said the apostle called himself *Paul*, from his name. The Spaniards will have him to be their apostle, which is not improbable; and it is said he died a martyr at Narbonne.

PAUL V. by birth a Roman, was first clerk of the chamber, and afterwards nuncio to Clement VIII. in Spain, who honoured him with a cardinal's hat. He was advanced to the papal chair the 16th of May 1605, after Leo XI. The ancient quarrel between the secular and ecclesiastical jurisdictions, which in former times had occasioned so much bloodshed, revived in the reign of this pontiff. The senate of Venice had condemned by two decrees, 1. The new foundations of monasteries made without their concurrence. 2. The alienation of the estates both ecclesiastical and secular. The first decree passed in 1603, and the second in 1605. About the same time a canon and abbot, accused of rapine and murder, were arrested by order of the senate, and delivered over to the secular court; a circumstance which could not fail to give offence to the court of Rome. Clement VIII. thought it proper to dissemble or take no notice of the affair; but Paul V. who had managed the Genoese upon a similar occasion, flattered himself with the hopes that the Venetians would be equally pliant. However, he was disappointed; for the senate maintained that they held their power to make laws of God only; and therefore they refused to revoke their decrees and deliver up the ecclesiastical prisoners into the hands of the nuncio, as the pope demanded. Paul, provoked at this behaviour, excommunicated the doge and senate; and threatened to put the whole state under an interdict, if satisfaction was not given him within the space of 14 hours. The senate did no more than protest against this menace, and forbid the publication of it throughout their dominions. A number of pamphlets, from both sides, soon announced the animosity of the two parties. The Capuchins, the Theatins, and Jesuits, were the only religious orders who observed the interdict. The senate shipped them all off for Rome, and the Jesuits were banished for ever. Meantime his holiness was preparing to make the refractory republic submit to his spiritual tyranny by force of arms. He levied troops against the Venetians; but he soon found his design baulked, as the cause of the Venetians appeared to be the common cause of all princes. He had recourse, therefore, to Henry IV. to settle the differences: and this prince had all the honour of bringing about a reconciliation between the contending parties. His ambassadors at Rome and Venice began the negotiation, and Cardinal de Joyeuse finished it in 1607. It was agreed upon, that this cardinal should declare at his entry into the senate, that the censures of the church were to be taken off, or that he would remove them; and that the doge should at the same time surrender to him the deeds of revocation and protest. It was also stipulated, that all the religious who were banished, except the Jesuits, should be restored to their former privileges. In fine, the Venetians promised to send an ambassador extraordinary to Rome, in order to thank the pope for the favour he had done them; but they would not allow the legate to speak of his holiness granting them absolution. Paul was wise enough to overlook the whole matter, but endeavoured to put an end to another dispute, which had been long agitated in the congregations *de auxiliis*. He caused it to be intimated in form to the disputants and counsellors, that, as the congregations were now dissolved, it was his express order that the contending parties should no longer continue to censure one another. Some authors have affirmed that Paul V. had drawn out a bull against the doctrine of Molina, which only wanted to be promulged; but for this fact there appears to be no other evidence than the draught of this bull, which we meet with in the end of the history of the above-mentioned congregations. Paul was strongly solicited, but in vain, to make *the immaculate conception of the holy virgin* an article of faith. He contented himself with fairly forbidding the contrary doctrine to be publicly taught, that he might not offend the Dominicans, who, at that time, maintained that she was conceived, like other human creatures, in original sin. His holiness afterwards applied himself to the embellishing of Rome, and was at great pains to collect the works of the most eminent painters and engravers. Rome is indebted to him for its most beautiful fountains, especially that where the water spouts out from an antique vase taken from the thermæ or hot-baths of Vespasian, and that which they call *aqua Paola*, an ancient work of Augustus, restored by Paul V. He brought water into it by an aqueduct 35 miles in length, after the example of Sixtus V. He completed the frontispiece of St Peter, and the magnificent palace of Mount Cavallo. He applied himself in a particular manner to the recovering and repairing ancient monuments, which he made to advance, as much as the nature of them would admit, the honour of Christianity; as appears from an elegant inscription placed upon a column of porphyry, taken from the temple of Peace, and bearing a beautiful statue of the Virgin, at the side of the church of St Mary the elder:

> "Impura falsi templa
> Quondam numinis
> Jubente moesta perferebam Cæsare:
> Nunc læta veri
> Perferens matrem Dei
> Te, Paule, nullis obticebo sæculis."

His pontificate was honoured with several illustrious embassies. The kings of Japan, Congo, and other Indian princes, sent ambassadors to him. He took care to supply them with missionaries, and to found bishopricks in these countries newly brought over to the faith. He showed the same attention to the Maronites and other eastern Christians. He sent legates to different orthodox princes, both to testify his esteem for them, and to confirm them in their zeal for religion. He died the 28th of January 1621, aged 69; after having confirmed the French Oratory, the Ursulines, the Order of Charity, and some other institutions. Bold in his claims, but of narrow views, he distinguished himself more by his piety and knowledge than by his politics. It has been remarked, that he never passed a single day of his popedom without celebrating mass. He enjoined all the religious in the prosecution of their studies to have regular professors for Latin, Greek, Hebrew, and Arabic; if there were any among themselves properly qualified; or if that was not the case, to take the assistance of laymen for that purpose, until there were some of their own order who had learning enough to instruct their brethren. It was very difficult to carry this decree into execution; and indeed it was always very imperfectly observed.

PAUL, *Father*, whose name, before he entered into the monastic life, was Peter Sarpi, was born at Venice, August 14. 1552. His father followed merchandise, but with so little success, that at his death he left his family very ill provided for; but under the care of a mother whose piety was likely to bring the blessing of providence upon them, and whose wise conduct supplied the want of fortune by advantages of greater value. Happily for young Sarpi she had a brother, master of a celebrated school, under whose direction he was placed by her. Here he lost no time, but cultivated his abilities, naturally of the first rate, with unwearied application. He was born for study, having a natural aversion to pleasure and gaiety, and a memory so tenacious that he could repeat 30 verses upon once hearing them. Proportionable to his capacity was his progress in literature: at 13, having made himself master of school learning, he turned his studies to philosophy and the mathematics, and entered upon logic under Capella of Cremona, who, though a celebrated master of that science, confessed himself in a very little time unable to give his pupil any farther instructions.

As Capella was of the order of the Servites, his scholar was induced by his acquaintance with him to engage in the same profession, though his uncle and his mother represented to him the hardships and austerities of that kind of life, and advised him with great zeal against it. But he was steady in his resolutions, and in 1566 took the habit of the order, being then only in his 14th year, a time of life in most persons very improper for such engagements, but in him attended with such maturity of thought, and such a settled temper, that he never seemed to regret the choice he then made, and which he confirmed by a solemn public profession in 1572.

At a general chapter of the Servites held at Mantua, Paul (for so we shall now call him) being then only 20 years old, distinguished himself so much in a public disputation by his genius and learning, that William duke of Mantua, a great patron of letters, solicited the consent of his superiors to retain him at his court, and not only made him public professor of divinity in the cathedral, and reader of casuistical divinity and canon law in that city, but honoured him with many proofs of his esteem. But Father Paul finding a court life not agreeable to his temper, quitted it two years afterwards, and retired to his beloved privacies, being then not only acquainted with the Latin, Greek, Hebrew, and Chaldee languages, but with philosophy, the mathematics, canon and civil law, all parts of natural philosophy, and chemistry itself; for his application was unintermitted, his head clear, his apprehension quick, and his memory retentive.

Being made a priest at 22, he was distinguished by the illustrious Cardinal Borromeo with his confidence, and employed by him on many occasions, not without the envy of persons of less merit, who were so far exasperated as to lay a charge against him before the Inquisition, for denying that the Trinity could be proved from the first chapter of Genesis; but the accusation was too ridiculous to be taken notice of. After this he passed successively through the dignities of his order, of which he was chosen provincial for the province of Venice at 26 years of age; and discharged his post with such honour, that in 1579 he was appointed, with two others, to draw up new regulations and statutes for his order. This he executed with great success; and when his office of provincial was expired, he retired for three years to the study of natural and experimental philosophy and anatomy, in which he is said to have made some useful discoveries. In the intervals of his employment he applied himself to his studies with so extensive a capacity, as left no branch of knowledge untouched. By him Acquapendente, the great anatomist, confesses that he was informed how vision is performed; and there are proofs that he was not a stranger to the circulation of the blood. He frequently conversed upon astronomy with mathematicians, upon anatomy with surgeons, upon medicine with physicians, and with chemists upon the analysis of metals, not as a superficial inquirer, but as a complete master. He was then chosen procurator general of his order; and during his residence at Rome was greatly esteemed by Pope Sixtus V. and contracted an intimate friendship with Cardinal Bellarmine and other eminent persons.

But the hours of repose, which he employed so well, were interrupted by a new information in the Inquisition; where a former acquaintance produced a letter written by him in cyphers, in which he said, "that he detested the court of Rome, and that no preferment was obtained there but by dishonest means." This accusation, however dangerous, was passed over on account of his great reputation; but made such impressions on that court, that he was afterwards denied a bishopric by Clement VIII. After these difficulties were surmounted, F. Paul again retired to his solitude; where he appears, by some writings drawn up by him at that time, to have turned his attention more to improvement in piety than learning. Such was the care with which he read the scriptures, that, it being his custom to draw a line under any passage which he intended more nicely to consider, there was not a single word in his New Testament but was underlined. The same marks of attention appeared in his Old Testament, Psalter, and Breviary.

But the most active scene of his life began about the year 1615; when Pope Paul V. exasperated by some decrees of the senate of Venice that interfered with the pretended rights of the church, laid the whole state under an interdict. The senate, filled with indignation at this treatment, forbade the bishops to receive or publish the pope's bull; and, convening the rectors of the churches, commanded them to celebrate divine service in the accustomed manner, with which most of them readily complied: but the Jesuits and some others refusing, were by a solemn edict expelled the state. Both parties having proceeded to extremities, employed their ablest writers to defend their measures. On the pope's side, among others, Cardinal Bellarmine entered the lists, and, with his confederate authors, defended the papal claims with great scurrility of expression, and very sophistical reasonings; which were confuted by the Venetian apologists in much more decent language, and with much greater solidity of argument. On this occasion F. Paul was most eminently distinguished by his Defence of the Rights of the supreme Magistrate, his Treatise of Excommunication, translated from Gerson, with an Apology, and other writings; for which he was cited before the Inquisition at Rome; but it may be easily imagined that he did not obey the summons.

The Venetian writers, whatever might be the abilities of their adversaries, were at least superior to them in the justice of their cause. The propositions maintained on the side of Rome were these: That the pope is invested with all the authority of heaven and earth: that all princes are his vassals, and that he may annul their laws at pleasure: that kings may appeal to him, as he is temporal monarch of the whole earth: that he can discharge subjects from their oaths of allegiance, and make it their duty to take up arms against their sovereign: that he may depose kings without any fault committed by them, if the good of the church requires it: that the clergy are exempt from all tribute to kings, and are not accountable to them even in cases of high-treason: that the pope cannot err: that his decisions are to be received and obeyed on pain of sin, though all the world should judge them to be false: that the pope is God upon earth: that his sentence and that of God are the same: and that to call his power in question is to call in question the power of God: maxims equally shocking, weak, pernicious, and absurd; of which it did not require the abilities and learning of F. Paul to demonstrate the falsehood and destructive tendency. It may be easily imagined that such principles were quickly overthrown, and that no court but that of Rome thought it for its interest to favour them. The pope, therefore, finding his authors confuted and his cause abandoned, was willing to conclude the affair by treaty; which, by the mediation of Henry IV. of France, was accommodated upon terms very much to the honour of the Venetians. But the defenders of the Venetian rights, though comprehended in the treaty, were excluded by the Romans from the benefit of it: some, upon different pretences, were imprisoned; some sent to the galleys; and all debarred from preferment. But their malice was chiefly aimed against F. Paul, who soon felt the effects of it; for as he was going one night to his convent, about six months after the accommodation, he was attacked by five ruffians armed with stilettoes, who gave him no less than 15 stabs, three of which wounded him in such a manner that he was left for dead. The murderers fled for refuge to the nunico, and were afterwards received into the pope's dominions; but were pursued by divine justice, and all, except one man who died in prison, perished by a violent death.

This, and other attempts upon his life, obliged him to confine himself to his convent, where he engaged in writing the History of the Council of Trent; a work unequalled for the judicious disposition of the matter, and artful texture of the narration; commended by Dr Burnet as the completest model of historical writing; and celebrated by Mr Worton as equivalent to any production of antiquity; in which the reader finds "liberty without licentiousness, piety without hypocrisy, freedom of speech without neglect of decency, severity without rigour, and extensive learning without ostentation."

In this, and other works of less consequence, he spent the remaining part of his life to the beginning of the year 1622, when he was seized with a cold and fever, which he neglected till it became incurable. He languished more than twelve months, which he spent almost wholly in a preparation for his passage into eternity; and among his prayers and aspirations was often heard to repeat, "Lord! now let thy servant depart in peace." On Sunday the eighth of January of the next year, he rose, weak as he was, to mass, and went to take his repast with the rest; but on Monday was seized with a weakness that threatened immediate death; and on Thursday prepared for his change, by receiving the viaticum, with such marks of devotion as equally melted and edified the beholders. Through the whole course of his illness to the last hour of his life he was consulted by the senate in public affairs, and returned answers in his greatest weakness with such presence of mind as could only arise from the consciousness of innocence.

On Saturday, the day of his death, he had the passion of our blessed Saviour read to him out of St John's gospel, as on every other day of that week, and spoke of the mercy of his Redeemer, and his confidence in his merits. As his end evidently approached, the brethren of his convent came to pronounce the last prayers, with which he could only join in his thoughts, being able to pronounce no more than these words, *Esto perpetua*, "Mayest thou last for ever;" which was understood to be a prayer for the prosperity of his country. Thus died F. Paul, in the 71st year of his age; hated by the Romans as their most formidable enemy, and honoured by all the learned for his abilities, and by the good for his integrity. His detestation of the corruption of the Roman church appears in all his writings, but particularly in this memorable passage of one of his letters: "There is nothing more essential than to ruin the reputation of the Jesuits. By the ruin of the Jesuits, Rome will be ruined; and if Rome be ruined, religion will reform of itself." He appears, by many passages in his life, to have had a high esteem for the church of England; and his friend F. Fulgentio, who had adopted all his notions, made no scruple of administering to Dr Duncombe, an English gentleman who fell sick at Venice, the communion in both kinds, according to the Common Prayer which he had with him in Italian. F. Paul was buried with great pomp at the public charge, and a magnificent monument was erected to his memory.

PAUL, in sea language is a short bar of wood or iron, fixed close to the capstern or windlass of a ship, to prevent those engines from rolling back or giving way when they are employed to heave in the cable, or otherwise charged with any great effort.

PAULIANISTS, PAULIANISTÆ, a sect of heretics, so called from their founder Paulus Samosatenus, a native of Samosata, elected bishop of Antioch in 262. His doctrine seems to have amounted to this: that the Son and the Holy Ghost exist in God in the same manner as the faculties of reason and activity do in man; that Christ was born a mere man; but that the reason or wisdom of the Father descended into him, and by him wrought miracles upon earth, and instructed the nations; and, finally, that on account of this union of the Divine Word with the man Jesus, Christ might, though improperly, be called God. It is also said, that he did not baptize in the name of the Father and the Son, &c.; for which reason the council of Nice ordered those baptized by him to be re-baptized.

Being condemned by Dionysius Alexandrinus in a council, he abjured his errors to avoid deposition; but soon after he resumed them, and was actually deposed by another council in 269.—He may be considered as the father of the modern Socinians; and his errors are severely condemned by the council of Nice, whose creed differs a little from that now used, under the same name, in the church of England. The creed agreed upon by the Nicene fathers, with a view to the errors of Paulus Samosatenus, concludes thus: τους δε λεγοντας ην ποτε ουκ ην και πριν γεννηθηναι, ουκ ην. &c. τουτους αναθεματιζει ἡ καθολικη και αποστολικη εκκλησια.——"But those who say there was a time when he was not, and that he was not before he was born, the catholic and apostolic church anathematizes." To those who have any veneration for the council of Nice this must appear a very severe, and perhaps not unjust, censure of some other modern sects as well as of the Socinians.

PAULICIANS, a branch of the ancient Manichees, so called from their founder, one Paulus, an Armenian, in the seventh century; who, with his brother John, both of Samosata, formed this sect: though others are of opinion, that they were thus called from another Paul, an Armenian by birth, who lived under the re of Justinian II. In the seventh century a zealot cal Constantine revived this drooping sect, which had s fered much from the violence of its adversaries, and v ready to expire under the severity of the imperial edi and that zeal with which they were carried into exe tion. The Paulicians, however, by their number, a the countenance of the emperor Nicephorus, beca formidable to all the East.

But the cruel rage of persecution, which had some years been suspended, broke forth with redoub violence under the reigns of Michael Curopalates a Leo the Armenian, who inflicted capital punishm on such of the Paulicians as refused to return into t bosom of the church. The empress Theodora, tutor of the emperor Michael, in 845, would oblige th either to be converted or to quit the empire: upon wh several of them were put to death, and more reti among the Saracens; but they were neither all ext minated nor banished.

Upon this they entered into a league with the Sa cens; and choosing for their chief an officer of t greatest resolution and valour, whose name was Carbe they declared against the Greeks a war which was c ried on for fifty years with the greatest vehemence a fury. During these commotions, some Paulicians, wards the conclusion of this century, spread abroad th doctrines among the Bulgarians; many of them, eit from a principle of zeal for the propagation of th opinions, or from a natural desire of flying from the p secution which they suffered under the Grecian yo retired, about the close of the eleventh century, fr Bulgaria and Thrace, and formed settlements in ot countries. Their first migration was into Italy; when in process of time, they sent colonies into almost all t other provinces of Europe, and formed gradually a co siderable number of religious assemblies, who adhered their doctrine, and who were afterwards persecuted w the utmost vehemence by the Roman pontiffs. In It they were called *Patarini*, from a certain place called *P taria*, being a part of the city of Milan, where they h their assemblies; and *Gathari* or *Gazari*, from Gazar or the Lesser Tartary. In France they were cal *Albigenses*, though their faith differed widely from th of the Albigenses, whom Protestant writers genera vindicate. (See ALBIGENSES). The first religio assembly the Paulicians had formed in Europe is said have been discovered at Orleans in 1017, under t reign of Robert, when many of them were condemn to be burnt alive. The ancient Paulicians, according Photius, expressed the utmost abhorrence of Manes a his doctrine. The Greek writers comprise their erro under the six following particulars: 1. They denied th this inferior and visible world is the production of t Supreme Being; and they distinguish the Creator of t world and of human bodies from the most high G who dwells in the heavens: and hence some have be led to conceive that they were a branch of the Gnosti rather than of the Manichæans. 2. They treated co temptuously the Virgin Mary; or, according to the us al manner of speaking among the Greeks, they refus to adore and worship her. 3. They refused to celebra the institution of the Lord's Supper. 4. They load the cross of Christ with contempt and reproach; which we are only to understand, that they refused

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follow the absurd and superstitious practice of the Greeks, who paid to the pretended wood of the cross a certain sort of religious homage. 5. They rejected, after the example of the greatest part of the Gnostics, the books of the Old Testament; and looked upon the writers of that sacred history as inspired by the Creator of this world, and not by the supreme God. 6. They excluded presbyters and elders from all part in the administration of the church.

PAULINA, a Roman lady, wife of Saturnius governor of Syria, in the reign of the emperor Tiberius. Her conjugal peace was disturbed, and violence was offered to her virtue, by a young man named Mundus, who fell in love with her, and had caused her to come to the temple of Isis by means of the priests of that goddess, who declared that Anubis wished to communicate to her something of moment. Saturnius complained to the emperor of the violence which had been offered to his wife; and the temple of Isis was overturned, and Mundus banished, &c.—There was besides a *Paulina*, wife of the philosopher Seneca. She attempted to kill herself when Nero had ordered her husband to die. The emperor, however, prevented her; and she lived some few years after in the greatest melancholy.

PAULINIA, a genus of plants belonging to the octandria class, and in the natural method ranking under the 23d order, *Trihilatæ*. See BOTANY *Index*.

PAULINUS, a bishop who flourished in the early part of the 7th century. He was the apostle of Yorkshire, having been the first archbishop of York. This dignity seems to have been conferred on him about the year 626. He built a church at Almonbury, and dedicated it to St Alban, where he preached to and converted the Brigantes. Camden mentions a cross at Dewsborough, which had been erected to him, with this inscription, *Paulinus hic prædicavit et celebravit*. York was so small about this time, that there was not so much as a small church in it in which King Edwin could be baptized. Constantius is said to have made it a bishopric. Pope Honorius made it a metropolitan see. We are told that Paulinus baptized in the river Swale, in one day, 10,000 men, besides women and children, on the first conversion of the Saxons to Christianity, besides many at Halystone. At Walstone, in Northumberland, he baptized Segbert king of the East Saxons. Bede says, "Paulinus coming with the king and queen to the royal manor called *Ad Gebdrin* (now Yeverin), staid there 36 days with them, employed in the duties of catechizing and baptizing. In all this time he did nothing from morning to night but instruct the people, who flocked to him from all the villages and places, in the doctrine of Christ and salvation; and, after they were instructed, baptizing them in the neighbouring river Glen." According to the same Bede, "he preached the word in the province of Lindissi; and first converted the governor of the city of Lindocollina, whose name was Blecca, with all his family. In this city he built a stone church of exquisite workmanship, whose roof being ruined by long neglect or the violence of the enemy, only the walls are now standing." He is also said to have founded a collegiate church of prebends near Southwell, in Nottinghamshire, dedicated to the Virgin Mary. This church he is said to have built when he baptized the Coritani in the Trent.

PAULO, Marco, a celebrated traveller, was son to Nicholas Paulo, a Venetian, who went with his brother Matthew, about the year 1255, to Constantinople, in the reign of Baudoin II. Nicholas, at his departure, left his wife big with child; and she brought to the world the famous Marco Paulo, the subject of this memoir. The two Venetians, having taken leave of the emperor, crossed the Black sea, and travelled into Armenia; whence they passed over land to the court of Barka, one of the greatest lords of Tartary, who loaded them with honours. This prince having been defeated by one of his neighbours, Nicholas and Matthew made the best of their way through the deserts, and arrived at the city where Kublai, grand khan of the Tartars, resided. Kublai was entertained with the account which they gave him of the European manners and customs; and appointed them ambassadors to the pope, in order to demand of his holiness a hundred missionaries. They came accordingly to Italy, obtained from the Roman pontiff two Dominicans, the one an Italian, the other an Asiatic, and carried along with them young Marco, for whom Kublai expressed a singular affection. This young man, having learned the different dialects of Tartary, was employed in embassies which gave him the opportunity of traversing Tartary, China, and other eastern countries. At length, after a residence of seventeen years at the court of the grand khan, the three Venetians returned to their own country, in the year 1295, with immense fortunes. A short time after his return, Marco serving his country at sea against the Genoese, his galley, in a great naval engagement, was sunk, and himself taken prisoner, and carried to Genoa. He remained there many years in confinement; and, as well to amuse his melancholy as to gratify those who desired it from him, he sent for his notes from Venice, and composed the history of his own and his father's voyages in Italian, under this title, *Delle maraviglie del mondo da lui vidute*, &c.; the first edition of which appeared at Venice, in 8vo, 1496. His work was translated into different languages, and inserted in various collections. The editions most esteemed are the Latin one published by Andrew Muller at Cologne, in 4to, 1671; and that in French, to be found in the collection of voyages published by Bergeron, at the Hague, 1735, in 2 vols 4to. In the writings of Marco Paulo, there are some things true and others highly incredible. It is indeed difficult to believe, that as soon as the grand khan was informed of the arrival of two Venetian merchants, who were come to sell theriaca (or treacle) at his court, he sent before them an escort of 40,000 men, and afterwards dispatched these Venetian ambassadors to the Pope, to beseech his holiness to send him a hundred missionaries. It is equally difficult to believe that the Pope, who doubtless had an ardent zeal for the propagation of the faith, instead of a hundred, should have sent him only two missionaries. There are therefore some errors and exaggerations in Marco Paulo's narrative; but many other things which were afterwards verified, and which have been of service to succeeding travellers, prove that in several respects his relation is valuable. He not only gave better accounts of China than had been before received; but likewise furnished a description of Japan, of many of the islands of the East Indies, of Madagascar, and the coasts of Africa; so that from his work it might be easily collected, that a direct passage by sea to the Indies was not only possible, but practicable. It may be worth while to add, that, in the opinion of the authors of the Universal History, what he wrote from his own knowledge is both curious and true, so that where he has erred his father and uncle must have deceived him.

PAULUS Æmilius. See *Æmilius Paulus.*

PAVO, the Peacock; a genus of birds belonging to the order of gallinæ. See Ornithology *Index.*

PAVO, in *Astronomy*, a constellation in the southern hemisphere, unknown to the ancients, and not visible in our latitude. It consists of 14 stars, of which the names and situations are as follows:

	Signs.	Longitude			Latitude South.			Magnitude.
		°	′	″	°	′	″	
The eye of the peacock	♑	20	0	3	36	11	18	2
In the breast		24	41	51	46	56	21	3
In the right wing		18	41	38	45	52	34	3
In the middle		3	42	28	44	29	8	3
In the root of the tail, first		3	53	24	44	6	13	5
second		2	42	11	41	37	9	5
third		3	55	22	39	3	23	4
fourth		5	11	3	37	10	46	6
fifth		0	49	34	38	54	14	5
sixth	♐	29	39	17	38	3	36	4
seventh		27	22	54	40	9	28	5
last		24	7	44	41	28	2	4
In the right foot	♑	1	22	11	48	6	3	4
In the left foot		9	43	7	50	49	7	4

See Astronomy.

PAVOR, a Roman deity, whose worship was introduced by Tullus Hostilius, who, in a panic, vowed a shrine to him, and one to Pallor, *Paleness;* and therefore they are found on the coins of that family.

PAUSANIA, in Grecian antiquity, a festival in which were solemn games, wherein nobody contended but free-born Spartans; in honour of Pausanias the Spartan general, under whom the Greeks overcame the Persians in the famous battle of Platæa.

PAUSANIAS, a Spartan king and general, who signalized himself at the battle of Platæa against the Persians. The Greeks, very sensible of his services, rewarded his merit with a tenth of the spoils taken from the Persians. He was afterwards appointed to command the Spartan armies, and he extended his conquests in Asia; but the haughtiness of his behaviour created him many enemies; and the Athenians soon obtained a superiority in the affairs of Greece.—Pausanias, dissatisfied with his countrymen, offered to betray Greece to the Persians, if he received in marriage as the reward of his perfidy the daughter of their king. His intrigues being discovered to the Ephori of Sparta, he fled for safety to a temple of Minerva; and as the sanctity of the place screened him from the violence of his pursuers, the sacred building was surrounded with heaps of stones, the first of which was carried there by the indignant mother of the unhappy man. He was starved to death in the temple, and died about 474 years before the Christian era.

Pausanias, a learned Greek historian and orator, in the second century, under the reign of Antoninu Philosopher, was the disciple of Herodes Atticus. lived for a long time in Greece; and afterwards to Rome, where he died at a great age. He wrot excellent description of Greece, in ten books; in w we find not only the situation of places, but the anti ties of Greece, and every thing most curious and thy of knowledge. Abbe Gedoin has given a Fr translation of it in 2 vols 4to.

PAUSE, a stop or cessation in speaking, sing playing, or the like. One use of pointing in gram is to make proper pauses, in certain places.—The a pause in the middle of each verse. See Poetry Reading.

PAW, in the manege. A horse is said to paw ground, when, his leg being either tired or painful does not rest it upon the ground, and fears to hurt self as he walks.

PAWN, a pledge or gage for surety or paymen money lent. It is said to be derived *à pugno, qui quæ pignori dantur, pugno vel manu traduntur.* party that pawns goods has a general property in th they cannot be forfeited by the party that hath the pawn for any offence of his, nor be taken in execu for his debt; neither may they otherwise be put in cution till the debt for which they are pawned is satis

If the pawn is laid up, and the pawnee robbed, h not answerable; though if the pawnee use the thing a jewel, watch, &c. that will not be the worse for w ing, which he may do, it is at his peril; and if h robbed, he is answerable to the owner, as the using casioned the loss, &c.

If the pawn is of such a nature that the keeping charge to the pawnee, as a cow or a horse, &c. he milk the one and ride the other, and this shall go in compense for his keeping.

Things which will grow the worse by using, as a rel, &c. he may not use.

PAYS DE CALAIS, a department in the north France, lying along the straits of Calais. Its territ al extent is 1,331,719 arpents, or 1,650,000 acres 2580 square miles. The population in 1800 566,061, and in 1817 it was 580,457. The con butions in 1802 were 4,558,519 francs. The clir of this department is cold and moist, and the soil is very fertile. It produces corn, tobacco, hemp, f and wool. There are coal mines and quarries of v ous kinds. The manufactures, which are chief woollens, are but inconsiderable. Arras is the c town. The department contains 6 sub-prefectures, cantons, and 953 communes.

PEA, in *Botany*. See Pisum.

PEACE, Temple of, a celebrated temple at Ro which was consumed by fire A. D. 191; produced, some writers suppose, by a slight earthquake, for thunder was heard at the time. Dio Cassius, howe supposes that it began in the adjoining houses. Be t as it will, the temple, with all the surrounding bui ings, was reduced to ashes. That magnificent struct had been raised by Vespasian after the destruction Jerusalem, and enriched with the spoils and ornam of the temple of the Jews. The ancients speak of it one of the most stately buildings in Rome. There of learning used to hold their assemblies, and lo their writings, as many others deposited their jew and whatever else they esteemed of great value. It

likew

likewise made use of as a kind of magazine for the spices that were brought by the Roman merchants out of Egypt and Arabia; so that many rich persons were reduced to beggary, all their valuable effects and treasures being consumed in one night, with the temple.

PEACH. See AMYGDALUS, BOTANY and GARDENING *Index*.

PEACOCK. See PAVO, ORNITHOLOGY *Index*.

PEAK OF DERBYSHIRE, a chain of very high mountains in the county of Derby in England, famous for the mines they contain, and for their remarkable caverns. The most remarkable of these are Pool's-hole and Elden-hole. The former is a cave at the foot of a high hill called *Coitmoss*, so narrow at the entrance that passengers are obliged to creep on all-fours; but it soon opens to a considerable height, extending to above a quarter of a mile, with a roof somewhat resembling that of an ancient cathedral. By the petrifying water continually dropping in many parts of the cave are formed a variety of curious figures and representations of the works both of nature and art. There is a column here as clear as alabaster, which is called *The Queen of Scots' Pillar*, because Queen Mary is said to have proceeded thus far when she visited the cavern. It seems the curiosity of that princess had led her thus far into this dark abode; and indeed there are few travellers who care to venture farther; but others, determined to see the end of all, have gone beyond it. After sliding down the rock a little way, is found the dreary cavity turned upwards: following its course, and climbing from crag to crag, the traveller arrives at a great height, till the rock, closing over his head on all sides, puts an end to any further subterraneous journey. Just at turning to descend, the attention is caught by chasm, in which is seen a candle glimmering at a vast depth underneath. The guides say, that the light is at a place near Mary Queen of Scots' pillar, and no less than 80 yards below. It appears frightfully deep indeed to look down; but perhaps does not measure any thing like what it is said to do. If a pistol is fired by the Queen of Scots' pillar, it will make a report as loud as a cannon. Near the extremity there is a hollow in the roof, called the *Needle's Eye*; in which if a candle is placed, it will represent a star in the firmament to those who are below. At a little distance from this cave is a small clear stream consisting of hot and cold water, so near each other, that the finger and thumb of the same hand may be put the one into the hot water and the other into the cold.

Elden-hole is a dreadful chasm in the side of a mountain; which, before the latter part of the last century, was thought to be altogether unfathomable. In the time of Queen Elizabeth, a poor man was let down into it for 200 yards; but he was drawn up in a frenzy, and soon after died. In 1682, it was examined by Captain Collins, and in 1699 by Captain Sturmy, who published their accounts in the Philosophical Transactions. The latter descended by ropes fixed at the top of an old lead-ore pit, four fathoms almost perpendicular, and from thence three fathoms more obliquely, between two great rocks. At the bottom of this he found an entrance into a very spacious cavern, from whence he descended along with a miner for 25 fathoms perpendicular. At last they came to a great river or water, which he found to be 20 fathoms broad and eight fathoms deep. The miner who accompanied him, insisted that this water ebbed and flowed with the sea; but the Captain disproved this assertion, by remaining in the place from three hours flood to two hours ebb, during which time there was no alteration in the height of the water. As they walked by the side of this water, they observed a hollow in the rock some feet above them. The miner went into this place, which was the mouth of another cavern; and walked for about 70 paces in it, till he just lost sight of the Captain. He then called to him, that he had found a rich mine; but immediately after came running out and crying, that he had seen an evil spirit; neither could any persuasions induce him to return. The floor of these caverns is a kind of white stone enamelled with lead ore, and the roofs are encrusted with shining spar. On his return from this subterraneous journey, Captain Sturmy was seized with a violent headach, which, after continuing four days, terminated in a fever, of which he died in a short time.

PEAK *of Teneriffe*. See TENERIFFE.

PEAN, in *Heraldry*, is when the field of a coat of arms is sable, and the powderings or.

PEAR. See PYRUS, BOTANY and GARDENING *Index*.

PEAR-*Glass*. See VITREA *Lacryma*.

PEARCE, DR, lord bishop of Rochester, was the son of a distiller in High Holborn. He married Miss Adams, the daughter of a distiller in the same neighbourhood, with a considerable fortune, who lived with him 52 years in the highest degree of connubial happiness. He had his education in Westminster school, where he was distinguished by his merit, and elected one of the king's scholars. In 1710, when he was 20 years old, he was elected to Trinity College, Cambridge. During the first years of his residence at the university, he sometimes amused himself with lighter composition, some of which are inserted in the Guardian and Spectator. In 1716, he published his edition of *Cicero de Oratore*, and, at the desire of a friend, luckily dedicated it to Lord Chief Justice Parker (afterwards Earl of Macclesfield), to whom he was a stranger. This incident laid the foundation of his future fortune; for Lord Parker soon recommended him to Dr Bentley, master of Trinity, to be made one of the fellows; and the doctor consented to it on this condition, that his lordship would promise to *unmake* him again as soon as it lay in his power to give him a living. In 1717, Mr Pearce was ordained at the age of 27; having taken time enough, as he thought, to attain a sufficient knowledge of the sacred office. In 1718, Lord Parker was appointed chancellor, and invited Mr Pearce to live with him in his house as chaplain. In 1719, he was instituted into the rectory of Stappleford Abbots, in Essex; and in 1720, into that of St Bartholomew, behind the Royal Exchange, worth 400l. *per annum*. In 1723, the lord chancellor presented him to St Martin's in the Fields. His Majesty, who was then at Hanover, was applied to in favour of St Claget, who was then along with him; and the doctor actually kissed hands upon the occasion; but the chancellor, upon the king's return, dis-

Pearce. puted the point, and was permitted to present Mr Pearce.—Mr Pearce soon attracted the notice and esteem of persons in the highest stations and of the greatest abilities. Besides Lord Parker, he could reckon amongst his patrons or friends, Lord Macclesfield, Mr Pulteney (afterwards Earl of Bath), Archbishop Potter, Lord Hardwicke, Sir Isaac Newton, and other illustrious personages.—In 1724, the degree of doctor of divinity was conferred on him by Archbishop Wake. The same year he dedicated to his patron the earl of Macclesfield, his edition of *Longinus on the Sublime*, with a new Latin version and notes.

When the church of St Martin's was rebuilt, Dr Pearce preached a sermon at the consecration, which he afterwards printed, and accompanied with an essay on the origin and progress of temples, traced from the rude stones which were first used for altars to the noble structure of Solomon, which he considers as the first temple completely covered. His observations on that building which is called the *Temple of Dagon* removes part of the difficulty which presents itself in the narration of the manner in which Samson destroyed it.

The deanery of Winchester becoming vacant, Dr Pearce was appointed dean in 1739; and in the year 1744 he was elected prolocutor of the lower house of convocation for the province of Canterbury. His friends now began to think of him for the episcopal dignity; but Mr Dean's language rather declined it. However, after several difficulties had been started and removed, he consented to accept the bishopric of Bangor, and promised Lord Hardwicke to do it with a good grace. He accordingly made proper acknowledgements of the royal goodness, and was consecrated Feb. 12. 1748. Upon the declining state of health of Dr Wilcocks, bishop of Rochester, the bishop of Bangor was several times applied to by Archbishop Herring to accept of Rochester, and the deanery of Westminster, in exchange for Bangor; but the bishop then first signified his desire to obtain leave to resign and retire to a private life. His lordship, however, upon being pressed, suffered himself to be prevailed upon.—"My Lord (said he to the duke of Newcastle), your grace offers these dignities to me in so generous and friendly a manner, that I promise you to accept them." Upon the death of Bishop Wilcocks he was accordingly promoted to the see of Rochester and deanery of Westminster in 1756. Bishop Sherlock died in 1761, and Lord Bath offered his interest for getting the bishop of Rochester appointed to succeed him in the diocese of London; but the bishop told his lordship, that he had determined never to be bishop of London or archbishop of Canterbury.

In the year 1763, his lordship being 73 years old, and finding himself less fit for the business of his stations as bishop and dean, informed his friend Lord Bath of his intention to resign both, and live in a retired manner upon his private fortune. Lord Bath undertook to acquaint his majesty; who named a day and hour, when the bishop was admitted alone into the closet. He told the king, that he wished to have some interval between the fatigues of business and eternity; and desired his majesty to consult proper persons about the propriety and legality of his resignation. In about two months the king informed him, that Lord Mansfield saw no objection; and that Lord Northington, who been doubtful, on further consideration thought that request might be complied with. Unfortunately for bishop, Lord Bath applied for Bishop Newton to s ceed. This alarmed the ministry, who thought no dignities should be obtained but through their ha They therefore opposed the resignation; and his maj was informed that the bishops disliked the design. majesty sent to him again; and at a third audience him, that he must think no more of resigning. bishop replied, "Sire, I am all duty and submissio and then retired.

In 1768 he obtained leave to resign the deanery; 1773, he lost his lady; and after some months of lin ing decay, he died at Little Ealing, June 29. 1774.

This eminent prelate distinguished himself in ev part of his life by the virtues proper to his station. literary abilities, and application to sacred and phil gical learning, appear by his works; the principal which are, A letter to the clergy of the church of E land, on occasion of the bishop of Rochester's com ment to the Tower, 2d edit. 1722. Miracles of Je vindicated, 1727 and 1728. A review of the tex Milton, 1733. Two letters against Dr Middleton, casioned by the doctor's letter to Waterland, on publication of his treatise, intitled, *Scripture Vindica* 3d edit. 1752. And since his death, a commentary w notes on the four Evangelists and the acts of the A stles, together with a new translation of St Paul's Epistle to the Corinthians, with a paraphrase and no have been published, with a life prefixed, from ori nal MSS. in 2 vols 4to.

The following character of this excellent bishop published in the Gentleman's Magazine for 1775, was written, as we are told, by a contemporary friend. "The world has not lost for many years a m respectable member of society than the late Dr Pear nor the clergy a more pious and learned prelate. In younger days, before he became a graduate, he publi ed that excellent edition of Longinus, still admired quoted by the best critics. What is said of Longi himself by our excellent English poet, is as applica to the editor: 'He is himself the great sublime draws;' for very few of his order ever arrived at t perfection in eloquence, for which he was so justly ce brated. His diction was simple, nervous, and flowin his sentiments were just and sublime; more sublime th the heathen critic, in proportion to the superior sublim of the Christian revelation. Yet he was never puffed with the general applauses of the world, but of an hu ble deportment, resembling the meek Jesus as far as t weakness of human nature can resemble a character wi out sin. His countenance was always placid, and d played the benevolence of his heart, if his extensive ch rity had not proved it to a demonstration. His thirst knowledge prompted him to a very studious life, a that rendered both his complexion and constitution de cate; yet it held out by the blessing of Providence b yond the 85th year of his age; which is the more e traordinary, considering the midnight lamp had cast paleness over his complexion; yet with all his learni and knowledge, his humility and modesty restrained hi from many publications, which the world may hope f from his executors; one particularly in divinity, whi has been the object of his contemplation for many yea past. With a view to complete that work, and to retire from the bustle of the word, he struggled so hard to resign his bishopric, &c. After possessing the esteem and veneration of all who knew him for a long series of years, either as rector of a very large parish, or as a dignitary of the church, he has left the world in tears; and gone to receive the infinite reward of his piety and virtue."

PEARCH. See PERCA, ICHTHYOLOGY *Index*.

PEARCH-Glue, the name of a kind of glue, of remarkable strength and purity, made from the skins of pearches.

PEARL, in *Natural History*, a hard, white, shining body, usually roundish, found in a testaceous fish, a species of *Mya;* which see, CONCHOLOGY *Index*.

Pearls, though esteemed of the number of gems, and high valued in all ages, proceed only from a distemper in the animal that produces them, analogous to the bezoars and other stony concretions in several animals of other kinds. For an account of the mode of formation of the pearl, see CONCHOLOGY, p. 476; for the history of the pearl fishery in the bay of Condatchy in Ceylon, see CEYLON, p. 363; see also Cordiner's History of that island, 4to.

Mr Bruce mentions a muscle found in the salt springs of the Nubian desert; in many of which he found those excrescences which might be called pearls, but all of them ill formed, foul, and of a bad colour, though of the same consistence, and lodged in the same part of the body as those in the sea. "The muscle, too (says our author), is in every respect similar, I think larger. The outer skin or covering of it is of a vivid green. Upon removing this, which is the epidermis, what next appears is a beautiful pink without gloss, and seemingly of a calcareous nature. Below this, the mother-of-pearl, which is undermost, is a white without lustre, partaking much of the blue and very little of the red; and this is all the difference I observed between it and the pearl-bearing muscle of the Red sea.

"In Scotland, especially to the northward, in all rivers running from lakes, there are found muscles that have pearls of more than ordinary merit, though seldom of large size. They were formerly tolerably cheap, but lately the wearing of real pearls coming into fashion, those of Scotland have increased in price greatly beyond their value, and superior often to the price of oriental ones when bought in the east. The reason of this is a demand from London, where they are actually employed in work, and sold as oriental. But the excellency of all glass or paste manufactory, it is likely, will keep the price of this article, and the demand for it, within bounds, when every lady has it in her power to wear in her ears, for the price of sixpence, a pearl as beautiful in colour, more elegant in form, lighter and easier to carry, and as much bigger as she pleases, than the famous ones of Cleopatra and Servilia. In Scotland, as well as in the east, the smooth and perfect shell rarely produces a pearl; the crooked and distorted shell seldom wants one.

The mother-of-pearl manufactory is brought to the greatest perfection at Jerusalem. The most beautiful shell of this kind is that of the peninim already mentioned; but it is too brittle to be employed in any large pieces of workmanship; whence that kind named *dora* is most usually employed; and great quantities of this are daily brought from the Red sea to Jerusalem. Of these, all the fine works, the crucifixes, the wafer-boxes, and the beads, are made, which are sent to the Spanish dominions in the New World, and produce a return incomparably greater than the staple of the greatest manufactory in the Old.

Very little is known of the natural history of the pearl fish. Mr Bruce says, that, as far as he has observed, they are all stuck upright in the mud by an extremity; the muscle by one end, the pinna by the small sharp point, and the third by the hinge or square part which projects from the round. "In shallow and clear streams (says Mr Bruce), I have seen small furrows or tracks upon the sandy bottom, by which you could trace the muscle from its last station; and these not straight, but deviating into traverses and triangles, like the course of a ship in a contrary wind laid down upon a map, probably in pursuit of food. The general belief is, that the muscle is constantly stationary in a state of repose, and cannot transfer itself from place to place. This is a vulgar prejudice, and one of those facts that are mistaken for want of sufficient pains or opportunity to make more critical observations. Others, finding the first opinion a false one, and that they are endowed with power of changing place like other animals, have, upon the same foundation, gone into the contrary extreme, so far as to attribute swiftness to them, a property surely inconsistent with their being fixed to rocks. Pliny and Solinus say that the muscles have leaders, and go in flocks; and that their leader is endowed with great cunning to protect himself and his flock from the fishers; and that, when he is taken, the others fall an easy prey. This, however, we may justly look upon to be a fable; some of the most accurate observers having discovered the motion of the muscle, which indeed is wonderful, and that they lie in beds, which is not at all so, have added the rest, to make their history complete." Our author informs us, that the muscles found in the salt springs of Nubia likewise travel far from home, and are sometimes surprised, by the ceasing of the rains, at a greater distance from their beds than they have strength and moisture to carry them. He assures us, that none of the pearl-fish are eatable; and that they are the only fish he saw in the Red sea that cannot be eaten.

Artificial PEARLS. Attempts have been made to take out stains from pearls, and to render the foul opaque-coloured ones equal in lustre to the oriental. Numerous processes are given for this purpose in books of secrets and travels; but they are very far from answering what is expected from them. Pearls may be cleaned indeed from any external foulnesses by washing and rubbing them with a little Venice soap and warm water, or with ground rice and salt, with starch and powder blue, plaster of paris, coral, white vitriol and tartar, cuttle-bone, pumice-stone, and other similar substances; but a stain that reaches deep into the substance of pearls is impossible to be taken out. Nor can a number of small pearls be united into a mass similar to an entire natural one, as some pretend.

There are, however, methods of making artificial pearls, in such manner as to be with difficulty distinguished from the best oriental. The ingredient used for this purpose was long kept a secret; but it is now discovered to be a fine silver-like substance found upon the under side of the scales of the blay or bleak fish. The scales, taken off in the usual manner, are washed and rubbed with fresh parcels of fair water, and the several liquors suffered to settle: the water being then poured off, the pearly matter remains at the bottom, of the consistence of oil, called by the French *essence d'orient*. A little of this is dropped into a hollow bead of bluish glass, and shaken about so as to line the internal surface; after which the cavity is filled up with wax, to give solidity and weight. Pearls made in this manner are distinguishable from the natural only by their having fewer blemishes.

*Mother-of-*PEARL, the shell, not of the pearl oyster, but of the *mytilus margaritiferus*. See MYTILUS, CONCHOLOGY *Index*.

PEARL-Ash, a fixed alkaline salt, prepared chiefly in Germany, Russia, and Poland, by melting the salts out of the ashes of burnt wood; and having reduced them again to dryness, evaporating the moisture, and calcining them for a considerable time in a furnace moderately hot. The goodness of pearl-ashes must be distinguished by a uniform and white appearance, they are nevertheless subject to a common adulteration, not easy to be distinguished by the mere appearance: which is done by the addition of common salt. In order to find out this fraud, take a small quantity of the suspected salt; and after it has been softened by lying in the air, put it over the fire in a shovel: if it contains any common salt, a crackling and slight explosion will take place as the salt grows hot.

Pearl-ashes are much used in the manufacture of glass, and require no preparation, except where very great transparency is required, as in the case of looking-glass, and the best kind of window-glass. For this purpose dissolve them in four times their weight of boiling water: when they are dissolved, let the solution be put into a clean tub, and suffered to remain there 24 hours or more. Let the clear part of the fluid be then decanted off from the sediment, and put back into the iron pot in which the solution was made; in this let the water be evaporated till the salts be left perfectly dry. Keep those that are not designed for immediate use in stone jars, well secured from moisture and air.

Mr Kirwan, who instituted a set of experiments on the alkaline substances used in bleaching, &c. (see *Irish Transact.* for 1789), tells us, that in 100 parts of the Dantzick pearl-ash, the vegetable alkali amounted to somewhat above 63. His pearl-ash he prepares by calcining a ley of vegetable ashes dried into a salt to whiteness. In this operation, he says, "particular care should be taken that it should not melt, as the extractive matter would not be thoroughly consumed, and the alkali would form such a union with the earthy parts as could not easily be dissolved." He has "added this caution, as Dr Lewis and Mr Dossie have inadvertently directed the contrary." We apprehend, however, that here is a little inaccuracy; and that it was not for pearl-ash, but for the unrefined pot-ash, that these gentlemen directed fusion. The fact is, that the American pot-ashes, examined by them, had unquestionably suffered fusion; which was effected in the same iron pot in which the evaporation was finished, by rather increasing the fire at the end of the process: by this management, one of the most troublesome operations in the whole manufacture, the separation of the hard salt from the vessels with hammers and chissels, was avoided; and though the extractive matter was not consumed, it was burnt to an indissoluble coal; so that the salt, though black itself, duced a pale or colourless solution, and was uncomm strong. Mr Kirwan has also given tables of the q tities of ashes and salt obtained from different v tables; and he concludes from them, 1. "That in neral weeds yield much more ashes, and their ashes m more salt, than woods; and that consequently, a salts of the vegetable alkali kind, neither Amer Trieste, nor the northern countries, possess any ad tage over us. 2. That of all weeds, fumitory prod most salt, and next to it wormwood; but if we att only to the quantity of salt in a given weight of as the ashes of wormwood contain most. *Trifolium fi num* also produces more ashes and salt than fern." POTASH.

PEARSON, JOHN, a very learned English bisho the 17th century, was born at Snoring in 1613. A his education at Eton and Cambridge, he entered holy orders in 1639, and was the same year collate the prebend of Netherhaven in the church of Sarum. 1640 he was appointed chaplain to the lord-keeper Fin and by him presented to the living of Torrington in folk. In 1650 he was made minister of St Clemen East-Cheap, in London. In 1657, he and Mr Gunn had a dispute with two Roman Catholics upon the s ject of schism; a very unfair account of which was pri ed at Paris in 1658. Some time after, he publishe London An Exposition of the Creed, in folio, dedica to his parishioners of St Clement's East-Cheap, to wh the substance of that excellent work had been preac several years before, and by whom he had been desi to make it public. The same year he likewise publis The Golden Remains of the ever memorable Mr J Hales of Eton; to which he prefixed a preface, conta ing, of that great man, with whom he had been quainted for many years, a character drawn with gr elegance and force. Soon after the Restoration, he presented by Juxon, then bishop of London, to the r tory of St Christopher's in that city; created docto divinity at Cambridge, in pursuance of the king's lett mandatory; installed prebendary of Ely, archdeacon Surry; and made master of Jesus college in Cambrid all before the end of the year 1668. March 25th 16 he was appointed Margaret professor of divinity in t university; and, the first day of the ensuing year, w nominated one of the commissioners for the review the liturgy in the conference at the Savoy. April 14 1662, he was admitted master of Trinity college Cambridge; and, in August, resigned his rectory of Christopher's and prebend of Sarum.—In 1667 he w admitted a Fellow of the Royal Society. In 1672 published at Cambridge, in 4to, *Vindiciæ Epistolaru S. Ignatii*, in answer to M. Daillé; to which is subjoine *Isaaci Vossii epistolæ duæ adversus Davidem Blond lum*. Upon the death of the celebrated Wilkins, Pea son was appointed his successor in the see of Chester, which he was consecrated February 9th 1672-3. 1682, his *Annales Cyprianici, sive tredecim annorum quibus S. Cyprian, inter Christianos versatus est, histor chronologica*, was published at Oxford, with Fell's ed tion of that Father's works. Pearson was disabled fro all public service by ill health a considerable time befo his death, which happened at Chester, July 16. 1686.

PEASANT, a hind, one whose business is in rur labour.

It is amongst this order of men that a philosopher would look for innocent and ingenious manners. The situation of the peasantry is such as secludes them from the devastations of luxury and licentiousness; for when the contagion has once reached the recesses of rural retirement, and corrupted the minds of habitual innocence, that nation has reached the summit of vice, and is hastening to that decay which has always been the effect of vicious indulgence. The peasantry of this country still in a great measure retain that simplicity of manners and rustic innocence which ought to be the characteristic of this order of society; and, in many parts, their condition is such as, were all its advantages sufficiently known, would create envy in the minds of those who have toiled through life, amidst the bustle of the world, in quest of that happiness which it could not confer.

O fortunatos nimium, sua si bona norint,
Agricolas.—— VIRGIL.

In other countries the peasants do not enjoy the same liberty as they do in our own, and are consequently not so happy. In all feudal governments they are abject slaves, entirely at the disposal of some petty despot. This was the case in Poland, where the native peasants were subject to the most horrid slavery, though those descended of the Germans, who settled in Poland during the reign of Boleslaus the Chaste and Cassimir the Great, enjoyed very distinguished privileges. Amongst the native slaves, too, those of the crown were in a better condition than those of individuals. See POLAND.

The peasants of Russia (Mr Coxe tells us) are a hardy race of men, and of great bodily strength. Their cottages are constructed with tolerable propriety, after the manner of those in Lithuania; but they are very poorly furnished. The peasants are greedy of money, and as the same author informs us, somewhat inclined to thieving. They afford horses to travellers, and act the part of coachmen and postilions. "In their common intercourse they are remarkably polite to each other: they take off their cap at meeting; bow ceremoniously and frequently, and usually exchange a salute. They accompany their ordinary discourse with much action, and innumerable gestures; and are exceedingly servile in their expressions of deference to their superiors: in accosting a person of consequence, they prostrate themselves, and even touch the ground with their heads. We were often struck at receiving this kind of eastern homage, not only from beggars, but frequently from children, and occasionally from some of the peasants themselves.

Coxe's Travels into Poland, Russia, Sweden, and Denmark.

"The peasants are well clothed, comfortably lodged, and seem to enjoy plenty of wholesome food. Their rye-bread, whose blackness at first disgusts the eye, and whose sourness the taste, of a delicate traveller, agrees very well with the appetite: as I became reconciled to it from use, I found it at all times no unpleasant morsel, and, when seasoned with hunger, it was quite delicious: they render this bread more palatable, by stuffing it with onions and groats, carrots or green corn, and seasoning it with sweet oil. The rye-bread is sometimes white, and their other articles of food are eggs, salt-fish, bacon, and mushrooms; their favourite dish is a kind of hodge podge, made of salt or sometimes fresh meat, groats, rye-flour, highly seasoned with onions and garlick, which latter ingredients are much used by the Russians. Besides, mushrooms are so exceedingly common in these regions, as to form a very essential part of their provision. I seldom entered a cottage without seeing great abundance of them; and in passing through the markets, I was often astonished at the prodigious quantity exposed for sale: their variety was no less remarkable than their number; they were of many colours, amongst which I particularly noticed white, black, brown, yellow, green and pink. The common drink of the peasants is quass, a fermented liquor, somewhat like sweet wort, made by pouring warm water on rye or barley meal; and deemed an excellent antiscorbutic. They are extremely fond of whisky, a spirituous liquor distilled from malt, which the poorest can occasionally command, and which their inclination often leads them to use to great excess."

These people are extremely backward in the mechanic arts, though, where they have much intercourse with other nations, this does not appear, and therefore does not proceed from natural inability; indeed we have already given an instance of one peasant of Russia, who seems to possess very superior talents. See NEVA.

The dress of these people is well calculated for the climate in which they live: they are particularly careful of their extremities. On their legs they wear one or two pair of thick worsted stockings; and they envelope their legs with wrappers of coarse flannel, or cloth, several feet in length, and over these they frequently draw a pair of boots, so large as to receive their bulky contents with ease. The lower sort of people are grossly ignorant; of which we shall give a very surprising instance in the words of Mr Coxe.—"In many families, the father marries his son while a boy of seven, eight, or nine years old, to a girl of a more advanced age, in order, as it is said, to procure an able-bodied woman for the domestic service: he cohabits with this person, now become his daughter-in-law, and frequently has several children by her. In my progress through Russia, I observed in some cottages, as it were, two mistresses of a family; one the peasant's real wife, who was old enough to be his mother; and the other, who was nominally the son's wife, but in reality the father's concubine. These incestuous marriages, sanctified by inveterate custom, and permitted by the parish-priests, were formerly more common than they are at present; but as the nation becomes more refined, and the priests somewhat more enlightened; and as they have lately been discountenanced by government, they are daily falling into disuse; and, it is to be hoped, will be no longer tolerated (A)."

The

(A) "The truth of this fact, which fell under my own observation, and which I authenticated by repeated inquiries from all ranks of people, is still further confirmed by the following passage in the Antidote to the Journey into Siberia, although the author gives another reason for those early marriages. 'The peasants and common people not

The peasants of Russia, like those of Poland, are divided into those of the crown and those of individuals; the first of which are in the best condition; but all of them undergo great hardships, being subject to the despotic will of some cruel overseer. They may obtain freedom, 1. By manumission on the death of their master, or otherwise: 2. By purchase; and, lastly, By serving in the army or navy. The empress has redressed some of the grievances of this class of her subjects. The hardiness of the peasants arises in a great measure from their mode of education and way of life, and from the violent changes and great extremes of heat and cold to which they are exposed.

"The peasants of Finland differ widely from the Russians in their look and dress: they have for the most part fair complexions, and many of them red hair: they shave their beards, wear their hair parted at the top, and hanging to a considerable length over their shoulders (B). We could not avoid remarking, that they were in general more civilized than the Russians; and that even in the smallest villages we were able to procure much better accommodations than we usually meet with in the largest towns which we had hitherto visited in this empire."

The peasants of Sweden (Mr Coxe informs us) are more honest than those in Russia; in better condition, and possessing more of the conveniencies of life, both with respect to food and furniture. "They are well clad in strong cloth of their own weaving. Their cottages, though built with wood, and only of one story, are comfortable and commodious. The room in which the family sleep is provided with ranges of beds in tiers (if I may so express myself), one above the other: upon the wooden testers of the beds in which the women lie, are placed others for the reception of the men, to which they ascend by means of ladders. To a person who has just quitted Germany, and been accustomed to tolerable inns, the Swedish cottages may perhaps appear miserable hovels; to me, who had been long used to places of far inferior accommodation, they seemed almost palaces. The traveller is able to procure many conveniences, and particularly a separate room from that inhabited by the family, which could seldom be obtained in the Polish and Russian villages. During my course through those two countries, a bed was a phenomenon which seldom occurred, excepting in the large towns, and even then not always completely equipped; but the poorest huts of Sweden were never deficient in this article of comfort: an evident proof that the Swedish peasants are more civilized than those of Poland and Russia.—After having witnessed the slavery of the peasants in those two countries, it was a pleasing satisfaction to find myself again among freemen, in a kingdom where there is a more equal division of property; where there is no vassalage; w the lowest order enjoy a security of their persons property; and where the advantages resulting from right are visible to the commonest observer."

The peasants of Holland and Switzerland are a a very tolerable condition; not subject to the und ted controul of a hireling master, they are free and enjoy in their several stations the blessings of dom. In Bohemia, Hungary, and a great part of many, they are legally slaves, and suffer all the mis attending such a condition. In Spain, Savoy, and I they are little better. In France, their situation such as to warrant the first Revolution; but by carr matters too far, they are now infinitely worse than were at any former period.

PEAT, a well known inflammable substance, in many parts of the world as fuel. There are species:

1. A yellowish-brown or black peat, found in m ish grounds in Scotland, Holland, and German When fresh, it is of a viscid consistence, but har by exposure to the air. It consists, according to wan, of clay mixed with calcareous earth and pyri sometimes also it contains common salt. While it is formed into oblong pieces for fuel, after the vitaceous and stony matters are separated. By di lation it yields water, acid, oil, and volatile alkali; ashes containing a small proportion of fixed alkali; being either white or red according to the proportio pyrites contained in the substance.

The oil which is obtained from peat has a very gent taste; and an empyreumatic smell, less fetid that of animal substances, more so than that of min bitumens: it congeals in the cold into a pitchy m which liquefies in a small heat: it readily catches from a candle, but burns less vehemently than o oils, and immediately goes out upon removing the ex nal flame; it dissolves almost totally in rectified s of wine into a dark brownish red liquor.

2. The second species is found near Newbury in B shire. In the Philosophical Transactions for the 1757, we have an account of this species; the substa of which is as follows:

Peat is a composition of the branches, twigs, lea and roots of trees, with grass, straw, plants, and we which having lain long in water, is formed into a m so soft as to be cut through with a sharp spade. colour is a blackish brown, and it is used in many pl for firing. There is a stratum of this peat on each the Kennet, near Newbury in Berks, which is about a quarter to half a mile wide, and many m long. The depth below the surface of the groun from one foot to eight. Great numbers of entire t

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not only marry their sons at 14 and 15 years of age, but even at eight or nine, and that for the sake of havi workwoman the more in the person of the son's wife: By the same rule, they try to keep their daughters si as long as possible, because they don't choose to lose a workwoman. These premature marriages are of little to the state; for which reason, methods to get the better of this custom have been sought for, and I hope soon take place: the bishops are attentive to prevent these marriages as much as possible, and have of late ceeded greatly in their endeavours. It is only the inhabitants of some of the provinces in Russia that still re this bad custom."

(B) The Russians have generally dark complexions and hair: they also wear their beards, and cut their short.

are found lying irregularly in the true peat. They are chiefly oaks, alders, willows, and firs, and appear to have been torn up by the roots; many horses heads, and bones of several kinds of deer, the horns of the antelope, the heads and tusks of boars, and the heads of beavers, are also found in it. Not many years ago an urn of a light brown colour, large enough to hold about a gallon, was found in the peat-pit in Speen moor, near Newbury, at about 10 feet from the river, and four feet below the level of the neighbouring ground. Just over the spot where the urn was found, an artificial hill was raised about eight feet high; and as this hill consisted both of peat and earth, it is evident that the peat was older than the urn. From the side of the river several semicircular ridges are drawn round the hill, with trenches between them. The urn was broken to shivers by the peat-diggers who found it, so that it could not be critically examined; nor can it be known whether any thing was contained in it.

For the mode of converting moss or peat into a valuable manure, see AGRICULTURE *Index*.

PEAUCIER, in *Anatomy*, a name given by Winslow, in his Treatise on the Head, and by some of the French writers, to the muscle called by Albinus *latissimus colli;* and by others *detrahens quadratus*, and *quadratus genæ*. Santorini has called the part of this which arises from the cheek *musculus risorius novus;* and some call the whole *platysma myoides*.

PEBBLES, a trivial name frequently given to different varieties of the agate. See AGATE, MINERALOGY *Index*.

PECARY, in *Zoology*. See MAMMALIA *Index*.

PECCANT, in *Medicine*, an epithet given to the humours of the body, when they offend either in quantity or quality, i. e. when they are either morbid, or in too great abundance. Most diseases arise from peccant humours, which are either to be corrected by alteratives and specifics, or else to be evacuated.

PECHEM, in the *Materia Medica*, a name given by the modern Greek writers to the root called *behem* by Avicenna and Serapion. Many have been at a loss to know what this root pechem was; but the virtues ascribed to it are the same with those of the behem of the Arabians; its description is the same, and the division of it into white and red is also the same as that of the behem. Nay, the word *pechem* is only formed of *behem* by changing the *b* into a *p*, which is very common, and the aspirate into χ, or *ch*, which is as common. Myrepsus, who treats of this root, says the same thing that the Arabian Avicenna says of behem, namely, that it was the fragments of a woody root, much corrugated and wrinkled on the surface, which was owing to its being so moist whilst fresh, that it always shrunk greatly in the drying.

PECHYAGRA, a name given by some authors to the gout affecting the elbow.

PECHYS, a name used by some anatomical writers for the elbow.

PECHYTYRBE, an epithet used by some medical writers for the scurvy.

PECK, a measure of capacity, four of which make a bushel.

PECK, *Francis*, a learned antiquarian, was born at Stamford in Lincolnshire, May 4. 1692, and educated at Cambridge, where he took the degrees of B. and M. A. He was the author of many works, of which the first is a poem, entitled, "Sighs on the Death of Queen Anne;" printed probably about the time of her death in 1714. Two years afterwards he printed "ΤΟ ῾ΥΨΟΣ ῞ΑΓΙΟΝ; or an Exercise on the Creation, and an Hymn to the Creator of the World; written in the express words of the sacred Text, as an Attempt to show the Beauty aud Sublimity of the Holy Scriptures, 1716, 8vo." In 1721, being then curate of King's Clifton in Northamptonshire, he issued proposals for printing the History and Antiquities of his native town, which was published in 1727, in folio, under the title of "*Academia tertia Anglicana;* or the Antiquarian Annals of Stamford in Lincoln, Rutland, and Northamptonshires; containing the History of the University, Monasteries, Gilds, Churches, Chapels, Hospitals, and Schools there, &c." inscribed to John duke of Rutland. This work was hastened by "An Essay on the ancient and present State of Stamford, 1726, 4to," written by Francis Hargrave, who, in his preface, mentions the difference which had arisen between him and Mr Peck, on account of the former's publication unfairly forestalling that intended by the latter. Mr Peck is also therein very roughly treated, on account of a small work he had formerly printed, entitled, "The History of the Stamford Bull-running." Mr Peck had before this time obtained the rectory of Godeby near Melton in Leicestershire, the only preferment he ever enjoyed. In 1729, he printed on a single sheet, "Queries concerning the Natural History and Antiquities of Leicestershire and Rutland," which were afterwards reprinted in 1740; but although the progress he had made in the work was very considerable, yet it never made its appearance. In 1732 he published the first volume of "*Desiderata Curiosa;* or, a Collection of divers scarce and curious Pieces relating chiefly to Matters of English History; consisting of choice tracts, memoirs, letters, wills, epitaphs, &c. transcribed, many of them, from the originals themselves, and the rest from divers ancient MS. copies, or the MS. collations of sundry famous antiquaries and other eminent persons, both of the last and present age: the whole, as nearly as possible, digested into order of time, and illustrated with ample notes, contents, additional discourses, and a complete index." This volume was dedicated to Lord William Manners, and was followed, in 1735, by a second volume, dedicated to Dr Reynolds bishop of Lincoln. In 1735 Mr Peck printed in a 4to pamphlet, "A complete catalogue of all the discourses written both for and against popery in the time of King James II. containing in the whole an account of 457 books and pamphlets, a great number of them not mentioned in the three former catalogues; with references after each title, for the more speedy finding a further account of the said discourses and their authors in sundry writers, and an alphabetical list of the writers on each side." In 1739 he was the editor of "Nineteen Letters of the truly reverend and learned Henry Hammond, D. D. (author of the Annotations on the New Testament, &c.) written to Mr Peter Stainnough and Dr Nathaniel Angelo, many of them on curious subjects, &c." These were printed from the originals, communicated by Mr Robert Marsden archdeacon of Nottingham, and Mr John Worthington. The next year, 1740, produced two volumes in 4to, one of them entitled, "Memoirs of the Life and Actions of Oliver Cromwell, as delivered in three panegyrics of him written in Latin; the first, as said, by Don Juan Roderiguez de Saa Meneses, Conde de Penguiao, the Portugal ambassador; the second, as affirmed by a certain Jesuit, the lord ambassador's chaplain; yet both, it is thought, composed by Mr John Milton (Latin secretary to Cromwell), as was the third; with an English version of each. The whole illustrated with a large historical preface; many similar passages from the Paradise Lost, and other works of Mr John Milton, and notes from the best historians. To all which is added, a collection of divers curious historical pieces relating to Cromwell, and a great number of other remarkable persons (after the manner of *Desiderata Curiosa*, v. i. and ii.)" The other, "New Memoirs of the Life and poetical Works of Mr John Milton; with, first, an examination of Milton's style; and secondly, explanatory and critical notes on divers passages in Milton and Shakespeare, by the editor. Thirdly, Baptistes; a sacred dramatic poem in defence of liberty, as written in Latin by Mr George Buchanan, translated into English by Mr John Milton, and first published in 1641, by order of the house of commons. Fourthly, the Parallel, or Archbishop Laud and Cardinal Wolsey compared, a Vision by Milton. Fifthly, the Legend of Sir Nicholas Throckmorton, knt. chief butler of England, who died of poison, *anno* 1570, an historical poem by his nephew Sir Thomas Throckmorton, knt. Sixth, Herod the Great, by the editor. Seventh, the Resurrection, a poem in imitation of Milton, by a friend. And eighth, a Discourse on the Harmony of the Spheres, by Milton; with prefaces and notes." These were the last publications which he gave the world. When these appeared, he had in contemplation no less than nine different works; but whether he had not met with encouragement for those which he had already produced, or whether he was rendered incapable of executing them by reason of his declining health, is uncertain; but none of them ever were made public. He concluded a laborious, and, it may be affirmed, an useful life, wholly devoted to antiquarian pursuits, Aug. 13. 1743, at the age of 61 years.

PECORA, in *Zoology*, the fifth order of the class mammalia, in the Linnean system. See ZOOLOGY.

PECQUET, JOHN, was a physician in Dieppe, and died at Paris in 1674. He was physician in ordinary to the celebrated Fouquet, whom he entertained at his spare hours with some of the most amusing experiments in natural philosophy. He acquired immortal honour to himself by the discovery of a lacteal vein, which conveys the chyle to the heart; and which from his name is called *le Reservoir de Pecquet*. This discovery was a fresh proof of the truth of the circulation of the blood: though it met with opposition from many of the learned, particularly from the famous Riolau, who wrote a treatise against the author of it, with this title: *Adversus Pecquetum et Pecquetianos*. The only works which we have of Pecquet, are, 1. *Experimenta nova Anatomica*, published at Paris, 1654. 2. A Dissertation, *De Thoracis Lacteis*, published at Amsterdam, 1661. He was a man of a lively and active genius; but his sprightliness sometimes led him to adopt dangerous opinions. He recommended, as a remedy for all diseases, the use of brandy. This remedy, however, proved fatal to himself, and contributed to shorten days, which he might have employed to the advanta of the public.

PECTEN, the SCALLOP; a species of shell-fi See OSTREA, CONCHOLOGY *Index*.

PECTORAL, a sacerdotal habit or vestment, w by the Jewish high-priest. The Jews called it *Hhosch* the Greeks λόγιον, the Latins *rationale* and *pector* and in our version of the Bible it is called *breastpla* It consisted of embroidered stuff, about a span squa and was worn upon the breast, set with twelve preci stones, ranged in four rows, and containing the names the twelve tribes. It was fastened to the shoulder two chains and hooks of gold. God himself prescrit the form of it. See BREASTPLATE.

PECTORAL, a breastplate of thin brass, about 12 gers square, worn by the poorer soldiers in the Rom army, who were rated under 1000 drachmæ. See RICA.

PECTORAL, an epithet for medicines good in disea of the breast and lungs.

PECTORALIS. See ANATOMY, *Table of Muscles*.

PECULATE, in *Civil Law*, the crime of emb zling the public money, by a person intrusted with receipt, management, or custody thereof. This te is also used by civilians for a theft, whether the thi be public, fiscal, sacred, or religious.

PECULIAR, in the *Canon Law*, signifies a par cular parish or church that has jurisdiction within its for granting probates of wills and administrations, empt from the ordinary or bishop's courts. The kin chapel is a royal peculiar, exempt from all spiritual risdiction, and reserved to the visitation and immedi government of the king himself. There is likewise archbishop's peculiar; for it is an ancient privilege the see of Canterbury, that wherever any manors advowsons belong to it, they forthwith become exer from the ordinary, and are reputed peculiars: th are 57 such peculiars in the see of Canterbury.

Besides these, there are some peculiars belonging deans, chapters, and prebendaries, which are only empted from the jurisdiction of the archdeacon: th are derived from the bishop, who may visit them, to whom there lies an appeal.

Court of PECULIARS, is a branch of, and annexed the court of ARCHES. It has a jurisdiction over all th parishes dispersed through the province of Canterb in the midst of other dioceses, which are exempt fr the ordinary's jurisdiction, and subject to the metro litan only. All ecclesiastical causes, arising wit these peculiar or exempt jurisdictions, are origina cognizable by this court: from which an appeal formerly to the pope, but now by the stat. 25 Hen VIII. c. 19. to the king in chancery.

PECULIUM, the stock or estate which a pers in the power of another, whether male or female, eit as his or her slave, may acquire by his industry. Rom slaves frequently amassed considerable sums in his w The word properly signifies the advanced price wh a slave could get for his master's cattle, &c. above price fixed upon them by his master, which was slave's own property.

In the Romish church, peculium denotes the go which each religious reserves and possesses to himse

PEDAI

PEDALS, the largest pipes of an organ, so called because played and stopped with the foot. The pedals are made square, and of wood; they are usually 13 in number. They are of modern invention, and serve to carry the sounds of an octave deeper than the rest. See ORGAN.

PEDAGOGUE, or PÆDAGOGUE, a tutor or master, to whom is committed the discipline and direction of a scholar, to be instructed in grammar and other arts. The word is formed from the Greek *παιδων ἀγωγος*, *puerorum ductor*, "leader of boys."

M. Fleury observes, that the Greeks gave the name *pædagogus* to slaves appointed to attend their children, lead them, and teach them to walk, &c. The Romans gave the same denomination to the slaves who were intrusted with the care and instruction of their children.

PEDANT, a schoolmaster or pedagogue, who professes to instruct and govern youth, teach them the humanities, and the arts. See PEDAGOGUE.

PEDANT is also used for a rough, unpolished man of letters, who makes an impertinent use of the sciences, and abounds in unseasonable criticisms and observations.

Dacier defines a pedant, a person who has more reading than good sense. See PEDANTRY.

Pedants are people ever armed with quibbles and syllogisms, breathe nothing but disputation and chicanery, and pursue a proposition to the last limits of logic.

Malebranche describes a pedant as a man full of false erudition, who makes a parade of his knowledge, and is ever quoting some Greek or Latin author, or hunting back to a remote etymology.

St Evremont says, that to paint the folly of a pedant, we must represent him as turning all conversation to some one science or subject he is best acquainted withal.

There are pedants of all conditions, and all robes. Wicquefort says, an ambassador, always attentive to formalities and decorums, is nothing else but a political pedant

PEDANTRY, or PEDANTISM, the quality or manner of a pedant. See PEDANT.

To swell up little and low things, to make a vain show of science, to heap up Greek and Latin, without judgment, to tear those to pieces who differ from us about a passage in Suetonius or other ancient authors, or in the etymology of a word, to stir up all the world against a man for not admiring Cicero enough, to be interested for the reputation of an ancient as if he were our next of kin, is what we properly call *pedantry*.

PEDARIAN, in Roman antiquity, those senators who signified their votes by their feet, not with their tongues; that is, such as walked over to the side of those whose opinion they approved of, in divisions of the senate.

Dr Middleton thus accounts for the origin of the word. He says, that though the magistrates of Rome had a right to a place and vote in the senate both during their office and after it, and before they were put upon the roll by the censors, yet they had not probably a right to speak or debate there on any question, at least in the earlier ages of the republic. For this seems to have been the original distinction between them and the ancient senators, as it is plainly intimated in the formule of the consular edict, sent abroad to summon the senate, which was addressed to all senators, and to all those who had a right to vote in the senate. From this distinction, those who had only a right to vote were called in ridicule *pedarians*; because they signified their votes by their feet, not their tongues, and upon every division of the senate, went over to the side of those whose opinion they approved. It was in allusion to this old custom, which seems to have been wholly dropt in the latter ages of the republic, that the more part of the senate continued still to be called by the name of *pedarians*, as Cicero informs us, who in giving an account to Atticus of a certain debate and decree of the senate upon it, says that it was made with the eager and general concurrence of the pedarians, though against the authority of all the consulars.

PEDATURA, a term used in Roman antiquity, for a space or proportion of a certain number of feet set out. This word often occurs in writers on military affairs: as in Hyginus de Castrametatione, we meet with *meminerimus itaque ad computatione cohortis equitatæ milliariæ pedaturam ad mille trecentos sexaginta duci debere*; which is thus explained: The pedatura, or space allowed for a *cohors equitata* or provincial cohort, consisting of both horse and foot, could not be the same as the pedatura of an uniform body of infantry, of the same number, but must exceed it by 360 feet; for the proportion of the room of one horseman to one foot soldier, he assigns as two and a half to one.

PEDERASTS, the same with SODOMITES.

PEDESTAL, in *Architecture*, the lowest part of an order of columns, being that part which sustains the column, and serves it as a foot to stand. See COLUMN.

PEDIÆAN, in Grecian antiquity. The city of Athens was anciently divided into three different parts; one on the descent of a hill; another on the sea-shore; and a third in a plain between the other two. The inhabitants of the middle region were called *Πεδιαιοι*, *Pedieans*, formed from *πεδιον*, "plain," or "flat;" or as Aristotle will have it, *Pediaci*: those of the hill, Diacrians; and those of the shore Paralians.

These quarters usually composed so many different factions. Pisistratus made use of the Pedieans against the Diacrians. In the time of Solon, when a form of government was to be chosen, the Diacrians chose it democratic; the Pedieans demanded an aristocracy; and the Paralians a mixed government.

PEDICLE, among botanists, that part of a stalk which immediately sustains the leaf of a flower or a fruit, and is commonly called a *footstalk*.

PEDICULUS, the LOUSE, a genus of insects belonging to the order of aptera. See ENTOMOLOGY *Index*.

PEDILUVIUM, or *BATHING of the FEET*. The uses of warm bathing in general, and of the pediluvium in particular, are so little understood, that they are often preposterously used, and sometimes as injudiciously abstained from.

In the Edinburgh Medical Essays, we find an ingenious author's opinion of the warm pediluvium, notwithstanding that of Borelli, Boerhaave, and Hoffman, to the contrary, to be, That the legs becoming warmer than before, the blood in them is warmed: this blood rarefying, distends the vessels; and in circulating imparts a great degree of warmth to the rest of the mass; and as there is a portion of it constantly passing through the legs, and acquiring new heat there, which heat is in-the course of circulation communicated to the rest of the blood, the whole mass rarefying, occupies a larger space, and of consequence circulates with greater force. The volume of the blood being thus increased, every vessel is distended, and every part of the body feels the effects of it; the distant parts a little later than those first beated. The benefit obtained by a warm pediluvium is generally attributed to its making a derivation into the parts immersed, and a revulsion from those affected, because they are relieved; but the cure is performed by the direct contrary method of operating, viz. by a greater force of circulation through the parts affected, removing what was stagnant or moving too sluggishly there. Warm bathing is of no service where there is an irresoluble obstruction, though, by its taking off from a spasm in general, it may seem to give a moment's ease; nor does it draw from the distant parts, but often hurts by pushing against matter that will not yield with a stronger impetus of circulation than the stretched and diseased vessel can bear: so that where there is any suspicion of scirrhus, warm bathing of any sort should never be used. On the other hand, where obstructions are not of long standing, and the impacted matter is not obstinate, warm baths may be of great use to resolve them quickly. In recent colds, with slight humoral peripneumonies, they are frequently an immediate cure. This they effect by increasing the force of the circulation, opening the skin, and driving freely through the lungs that lentor which stagnated or moved slowly in them. As thus conducing to the resolution of obstructions, they may be considered as short and safe fevers; and in using them we imitate nature, which by a fever often carries off an obstructing cause of a chronical ailment. Borelli, Boerhaave, and Hoffman, are all of opinion, that the warm pediluvium acts by driving a larger quantity of blood into the parts immersed. But arguments must give way to facts: the experiments related in the Medical Essays seem to prove to a demonstration, that the warm pediluvium acts by rarefying the blood.

A warm pediluvium, when rightly tempered, may be used as a safe cordial, by which circulation can be roused, or a gentle fever raised; with this advantage over the cordials and sudorifics, that the effect of them may be taken off at pleasure.

Pediluvia are sometimes used in the smallpox; but Dr Stevenson thinks their frequent tumultuous operations render that suspected, and at best of very doubtful effect; and he therefore prefers Mons. Martin of Lausanne's method of bathing the skin, not only of the legs, but of the whole body, with a soft cloth dipped in warm water, every four hours, till the eruption; by which means the pustules may become universally higher, and consequently more safe.

PEDIMENT. See ARCHITECTURE.

PEDLAR, a travelling foot-trader. See HAWKERS.

In Britain (and formerly in France) the pedlars are despised; but it is otherwise in certain countries. In Spanish America, the business is so profitable, that it is thought by no means dishonourable; and there are many gentlemen in Old Spain, who, when their circumstances are declining, send their sons to the Indies to retrieve their fortunes in this way. Almost all the commodities of Europe are distributed through the southern continent of America by means of these pedlars. They come from Panama to Paita by sea; in the road from the port last mentioned, they r Peura their first voyage to Lima. Some take the through Caxamalca: others, through Truxillo, a shore from Lima. They take their passage bac Panama by sea, and perhaps take with them a little go of brandy. At Panama they again stock thems with European goods, returning by sea to Paita, w they are put on shore; there they hire mules and them, the Indians going with them in order to lead t back. Their travelling expences are next to nothi for the Indians are brought under such subjection, they find lodging for them, and provender for t mules, frequently thinking it an honour done them their guests to accept of this for nothing, unless stranger now and then, out of generosity or compass makes a small recompense.

In Poland, where there are few or no manufactu almost all the merchandise is carried on by pedlars, are said to be generally Scotsmen, and who, in the re of King Charles II. are said to have amounted to fewer than 53,000.

PEDOMETER, or PODOMETER, formed from *pes*, "foot," and *μέτρον*, "measure," way-wiser; a chanical instrument, in form of a watch, consisting various wheels with teeth, catching in one another, disposed in the same plane; which by means of a *ch* or string fastened to a man's foot, or to the wheel o chariot, advance a notch each step, or each revolut of the wheel; so that the number being marked on edge of each wheel, one may number the paces, or m sure exactly the distance from one place to anoth There are some of them which mark the time on a di plate, and are in every respect much like a watch, a are accordingly worn in the pocket like a watch. S PERAMBULATOR.

PEDRO, DON, of Portugal, duke of Coimbra, w the fourth child and second surviving son of King Jo of Portugal, and was born March the 4th 1394. H father gave him an excellent education, which, join to strong natural abilities and much application, rende ed him one of the most accomplished princes of his tim He was not only very learned himself, but a great lov of learning, and a great patron of learned men. It w chiefly with a view to improve his knowledge that spent four years in travelling through different countri in Europe, Asia, and Africa, with a train suitable his quality; of which travels there is a relation still e tant, but so loaded with fabulous circumstances, that wounds the reputation it was designed to raise. At hi return he espoused Isabella, daughter to the count o Urgel, and grand-daughter to Don Pedro, the fourt king of Portugal, which was esteemed a very great ad vancement of his fortune. He was elected into the mos noble order of the Garter, April 22. 1417, in the fift year of the reign of his cousin Henry V. a grandson o John of Gaunt, by the father's side, as our duke o Coimbra was by the mother. In 1440 he was declare regent during the minority of his cousin Don Alonso V. son of King Edward, who died by the plague. He found some difficulty at first in the discharge of his office, both from the queen-mother and others. But, upon the whole, his administration was so mild and so just, that the magistrates and people of Lisbon concurred in demanding his leave to erect a statue to him. The regent

gent thanked them, said he should be unwilling to see a work of their's demolished; and that he was sufficiently rewarded by this public testimony of their affections. The queen dowager wished to raise disturbances in Portugal by aiming to recover the regency to herself; but the steadiness of the regent's administration, the attachment of the best part of the nobility to him, and his enjoying, in so absolute a degree, the confidence of the people, not only secured the interior tranquillity of the state, but raised the credit likewise of the crown of Portugal to a very great height in the sentiments of its neighbours: for, in the course of his regency, he had made it his continual study to pursue the public good; to ease the people in general, and the inhabitants of Lisbon in particular, of several impositions; to maintain the laws in their full vigour; to give the king an excellent education; and if that had been at all practicable, to diffuse a perfect unanimity through the court, by assuaging the malice and envy of his enemies. The king when he came of age, and the *cortes* or parliament, expressed their entire satisfaction with the regent's administration; and all parties entirely approved of the king's marriage with Donna Isabella, the regent's daughter, which was celebrated in 1446. The enmity of his enemies, however was not in the least abated by the regent's being out of office. They still persecuted him with their unjust calumnies, and unfortunately made the king hearken to their falsehoods. The unfortunate duke, when ordered to appear before the king, was advised to take with him an escort of horse and foot. In his passage he was proclaimed a rebel, and quickly after he was surrounded by the king's troops. Soon after he was attacked, and in the heat of action he was killed: nor was the envy of his enemies even then satiated; his body was forbid burial; and was at length taken away privately by the peasants. His virtue, however hated in courts, was adored by the uncorrupt part of his countrymen. At length, though, by an inspection of his papers, the king saw, when it was too late, the injustice that had been done the man who had behaved so well in so high and difficult an office; and whose papers only discovered signs of further benefit to the king and his dominions. In consequence of these discoveries, the duke's adherents were declared loyal subjects, all prosecutions were ordered to cease, and the king desired the body of Coimbra to be transported with great pomp from the castle of Abrantes to the monastery of Batalha; where it was interred in the tomb which he had caused to be erected for himself. The royal name of Don Pedro occurs often in the history of Portugal, and many who bore the name were singularly distinguished either for great abilities, or external splendour. See Portugal.

PEDUNCLE, in *Botany*. See Pedicle.

PEEBLES, a royal borough and county town of Peebles-shire or Tweedale, is situated on the banks of the Tweed, 22 miles south from Edinburgh. Peebles was a royal residence in the time of James I. of Scotland; and here it is supposed, he composed the poem of "Peebles at the Play." Peebles has considerable woollen manufactures, and excellent beer. The population in 1801 was 2088, and in 1811, 2485.

PEEBLES-SHIRE, or Tweedale, a county of Scotland, extending 36 miles in length and about 10 in breadth. It is bounded on the east by Ettrick Forest, on the south by Annandale, on the west by Clydesdale, and on the north by Mid-Lothian. Tweedale is a hilly country, well watered with the Tweed, the Yarrow, and a great number of smaller streams that fertilize the valleys, which produce good harvests of oats and barley, with some proportion of wheat. All the rivers of any consequence abound with trout and salmon. The lake called *West-Water Loch* swarms with a prodigious number of eels. In the month of August, when the west wind blows, they tumble into the river Yarrow in such shoals, that the people who wade in to catch them run the risk of being overturned. About the middle of this county is the hill or mountain of Braidalb, from the top of which the sea may be seen on each side of the island. Tweedale abounds with limestone and freestone. The hills are generally as green as the downs in Sussex, and feed innumerable flocks of sheep, that yield great quantities of excellent wool. The earls of March were hereditary sheriffs of Tweedale, which bestows the title of *marquis* on a branch of the ancient house of Hay, earls of Errol, and hereditary high constables of Scotland. The family of Tweedale is, by the female side, descended from the famous Simon de Fraser, proprietor of great part of this county, and who had a great share in obtaining the triple victory at Roslin. The chief town in Tweedale, is Peebles, a royal borough, and seat of a presbytery, pleasantly situated on the banks of the Tweed, over which there is at this place a stately stone bridge of five arches. In the neighbourhood of Peebles, near the village of Romano, on the river Lyne, we see the vestiges of two Roman castella, or stationary forts; and a great many terraces on the neighbouring hills, which perhaps have served as itinerary encampments. In the shire of Tweedale there are many ancient and honourable families. Douglas of Cavers, who was hereditary sheriff of the county, it is said still preserves the standard and the iron mace of the gallant Lord Douglas, who fell in the battle of Otterburn, just as his troops had defeated and taken Henry Percy, surnamed *Hotspur*. In the churchyard of Drumelzier, belonging to an ancient branch of the Hay family, the famous Merlin is supposed to lie buried. There was an old traditional prophecy, that the two kingdoms should be united when the waters of the Tweed and the Pansel should meet at his grave. Accordingly, the country people observe that this meeting happened in consequence of an inundation at the accession of James VI. to the crown of England. The valued rent of the county is 51,937l. 13s. 10d. Scots, and the real rent is estimated at 29,820l. sterling.

The population of this county, in 1801, amounted to 8717, and in 1811 to 9935. The following is the population at two different periods by parishes.

Parishes.	Population in 1755.	Population in 1790—1798.
1 Broughton	367	264
Drumelzier	305	270
Eddlestown	679	710
Glenholm	392	300
5 Inverleithen	559	560
Kilbucho	279	362
Kirkurd	310	288
Linton	831	928

Peebles-shire
Peers.

	Parishes.	Population in 1755.	Population in 1790—179[illegible].
	Lyne	265	160
10	Mannor	320	229
	Newlands	1009	891
	Peebles	1896	1920
	Skirling	335	234
	Stobo	313	318
15	Traquair	651	446
16	Tweedsmuir	397	227
		8908	8107

Decrease, 801 *

See PEEBLESHIRE, SUPPLEMENT.

* Statist. Hist. vol. xx.

PEEK, in the sea-language, is a word used in various senses. Thus the anchor is said to be a-peek, when the ship being about to weigh comes over her anchor in such a manner that the cable hangs perpendicularly between the hawse and the anchor.

To heave a-peek, is to bring the peek so as that the anchor may hang a-peek. A ship is said to ride a-peek, when lying with her main and fore-yards hoisted up, one end of her yards is brought down to the shrouds, and the other raised up on end; which is chiefly done when she lies in rivers, lest other ships falling foul of the yards should break them. Riding a-broad peek, denotes much the same, excepting that the yards are only raised to half the height.

Peek is also used for a room in the hold, extending from the bitts forward to the stern: in this room men of war keep their powder, and merchantmen their victuals.

PEEL, a town in the isle of Man, formerly called Holmstown, has a fort in a small island, and a garrison well supplied with cannon. In it are the ancient cathedral, the lord's house, with some lodgings of the bishops, and other remains of antiquity.

PEER, in general, signifies an equal, or one of the same rank and station: hence in the acts of some councils, we find these words, *with the consent of our peers, bishops, abbots*, &c. Afterwards the same term was applied to the vassals or tenants of the same lord, who were called *peers*, because they were all equal in condition, and obliged to serve and attend him in his courts; and peers *in fiefs*, because they all hold fiefs of the same lord.

The term *peers* is now applied to those who are impannelled in an inquest upon a person for convicting or acquitting him of any offence laid to his charge: and the reason why the jury is so called, is because, by the common law and the custom of this kingdom, every person is to be tried by his peers or equals; a lord by the lords, and a commoner by commoners. See the article JURY.

PEER of the Realm, a noble lord who has a seat and vote in the house of lords, which is also called the *House of Peers*.

These lords are called *peers*, because though there is a distinction of degrees in our nobility, yet in public actions they are equal, as in their votes in parliament, and in trying any nobleman or other person impeached by the commons, &c. See PARLIAMENT.

House of PEERS, or *House of Lords*,
the three estates of parliament. See LO
LIAMENT.

In a judicative capacity, the house of
preme court of the kingdom, having at pr
nal jurisdiction over causes, but only upo
writs of error; to rectify any injustice or
law committed by the courts below. To
they succeeded of course upon the dissolut
Regia. For as the barons of parliament we
members of that court, and the rest of it
was dealt out to other tribunals, over wh
officers who accompanied those barons wer
ly delegated to preside, it followed, that
receiving appeals, and superintending all o
tions, still remained in that noble assembly
every other great court was derived. Th
fore in all cases the last resort, from whose
farther appeal is permitted; but every sub
bunal must conform to their determination
reposing an entire confidence in the honou
science of the noble persons who compose thi
assembly, that they will make themselves
those questions upon which they undertake
since upon their decision all property must
pend. See LORDS, NOBILITY, &c.

PEERS, in the former government of F
twelve great lords of that kingdom; of whi
dukes and six counts; and of these, six wer
tics and six laymen: thus the archbishop of R
the bishop of Laon and Langres, were dukes,
and the bishops of Chalons on the Marn, N
Beauvais, were counts and peers. The duk
gundy, Normandy, and Aquitain, were lay
dukes; and the counts of Flanders, Cham
Toulouse, lay peers and counts. These peers
the coronation of kings, either in person or b
presentatives, where each performed the fu
tached to his respective dignity: but as the si
ages were all united to the crown, except th
count of Flanders, six lords of the first quality
sen to represent them: but the ecclesiastical p
rally assisted in person. The title of peer w
bestowed on every lord whose estate was erec
peerage; the number of which, as it depende
on the king, was uncertain.

PEERESS, a woman who is noble by desce
tion, or marriage. For, as we have noblemen o
ranks, so we may have noblewomen; thus Ki
ry VIII. made Anne Bullen marchioness of Pe
King James I. created the lady Compton, wi
Thomas Compton, countess of Buckingham, in
time of her husband, without any addition of h
him; and also the same king made the lady Fi
countess of Maidstone, and afterwards countess
chelsea, to her and the heirs of her body; an
George I. made the lady Schulenberg, duchess
dal.

If a peeress, by descent or creation, marry a
under the degree of nobility, she still continues
but if she obtain that dignity only by marria
loses it, on her afterwards marrying a commone
by the courtesy of England, she generally reta
title of her nobility.

A countess or baroness may not be arrested for debt or trespass; for though in respect of their sex, they cannot sit in parliament, they are nevertheless peers of the realm, and shall be tried by their peers, &c.

PEWIT, a species of gull. See LARUS, ORNITHOLOGY *Index*.

PEGASUS, among the poets, a horse imagined to have wings; being that on which Bellerophon was fabled to be mounted when he engaged the Chimera. See CHIMERA.

The opening of the fountain Hippocrene on Mount Hellicon is ascribed to a blow of Pegasus's hoof. It was feigned to have flown away to heaven, where it became a constellation. Hence

PEGASUS, in *Astronomy*, the name of a constellation of the northern hemisphere, in form of a flying horse. See ASTRONOMY.

PEGMARES, a name by which certain gladiators were distinguished, who fought upon moveable scaffolds called *pegmata*, which were sometimes unexpectedly raised, and by this means surprised the people with gladiators in hot contention. They were sometimes so suddenly lifted up as to throw the combatants into the air; and sometimes they were let down into dark and deep holes, and then set on fire, thus becoming the funeral-piles of those miserable wretches; and roasting them alive to divert the populace.

PEGU, a very considerable kingdom of Asia, beyond the Ganges. The country properly so called is but about 350 miles in length from north to south, and as much in breadth from east to west. It is situated on the eastern side of the bay of Bengal, nearly opposite to Arixa, and to the north-east of the coast of Coromandel. It is bounded on the north by the kingdoms of Arrakan and Ava; on the east by the Upper and Lower Siam, on the south by part of Siam and the sea; and on the west by the sea and part of Arrakan.

The kingdom of Pegu is said to have been founded about 1100 years ago. Its first king was a seaman; concerning whom and his successors we know nothing till the discovery of the East Indies by the Portuguese in the beginning of the 16th century. In 1518 the throne of Pegu was possessed by one Bressagukan, with whom Antony Correa the Portuguese ambassador solemnly concluded a peace in 1519. This monarch was possessed of a very large and rich empire, nine kingdoms being in subjection to him, whose revenues amounted to three millions of gold. We hear no farther accounts of his transactions after the conclusion of the treaty with the Portuguese. In 1539 he was murdered on the following occasion; Among other princes who were his tributaries was Para Mandara, king of the Birmans or Barmans. These people inhabited the high lands called *Pangavirau*, to the northward of the kingdom of Pegu. Their prince, by one of the terms of his vassalage, was obliged to furnish the king of Pegu with 30,000 Birmans to labour in his mines and other public works. As the king used frequently to go and see how his works went forward, and in these journeys took along with him none but his women, the Birmans observing these visits frequently repeated, formed a design of robbing the queen and all the concubines of their jewels; and pursuant to this design, the next time the king visited the works, they murdered him, and having stripped the ladies, fled to their own country.

By this enormity all Pegu was thrown into confusion: but, instead of revenging the death of their king, the people divided everywhere into factions; so that Dacha Rupi, the lawful heir to the crown, found himself unable to maintain his authority. Of these commotions, the king of the Birmans taking the advantage, not only shook off the yoke, but formed a design of conquering the kingdom of Pegu itself.—With this view he invaded the country with an army of more than a million of foot, and 5000 elephants; besides a great fleet which he sent down the river Ava towards Bagou or Pegu, the capital of the empire; while he himself marched thither by land. Just at this time Ferdinand de Mirales arrived at Pegu from Goa with a large galleon richly laden on account of the king of Portugal. As soon as Dacha Rupi heard of his coming, he sent to desire his assistance against the enemy. This he obtained by great presents and promises: and Mirales, setting out in a galliot, joined the king's ships. Had the numbers been any thing near an equality, the superior skill of Mirales would undoubtedly have gained the victory: But the fleet of the Birmans covered the whole river, though as large as the Ganges, while that of Dacha Rupi could scarcely be observed in comparison with them. Mirales did every thing that man could do, and even held out alone after the natives had deserted him; but at last, oppressed and overwhelmed with numbers, he was killed with all his men.

Thus Para Mandara became master of all Pegu; after which he attacked the tributary kingdoms. In 1544 he besieged Martavan, the capital of a kingdom of the same name, then very great and flourishing. The land forces which he brought against it consisted of 700,000 men, while by sea he attacked it with a fleet of 1700 sail; 100 of which were large galleys, and in them 700 Portuguese commanded by John Cayero, who had the reputation of being a valiant and experienced officer. The siege, however, continued seven months, during which time the Birmans lost 120,000 men; but at last the besieged king, finding himself straitened for want of provisions, and unable to withstand so great a power, offered terms of capitulation. The besiegers would admit of no terms, upon which the distressed king applied to the Portuguese in the service of his enemy; for by their assistance he doubted not to be able to drive away the Birmans. Accordingly, he sent one Seixas to Cayero, intreating him to receive himself, his family, and treasure, on board the four ships he had under his command; offering, on that condition, to give half his riches to the king of Portugal, to become his vassal, and pay such tribute as should be agreed upon. Cayero consulted the principal officers, and in their presence asked Seixas what he thought the treasure might amount to. Seixas answered, that out of what he had seen, for he had not seen all, two ships might be loaded with gold, and four or five with silver. This proposal was too advantageous to be slighted; but the rest of the officers envying the great fortune which Cayero would make, threatened to discover the whole to the king of Barma or Birma if he did not reject it. The unhappy king of Martavan had now no other resource but to set fire to the city, make a sally, and die honourably with the few men he had with him: but even here he was disappointed; for by the desertion of 4000 of his troops the enemy were apprised of his design, and prevented it. Thus

Pegu. betrayed, he capitulated with the Barma king for his own life and the lives of his wife and children, with leave to end his days in retirement. All this was readily granted, but the conqueror intended to perform no part of his promise. The city was plundered and burnt, by which above 60,000 persons perished, while at least an equal number were carried into slavery. Six thousand cannon were found in the place; 100,000 quintals of pepper, and an equal quantity of other spices. The day after this destruction, 21 gibbets were erected on a hill adjoining to the city; on which the queen, her children, and ladies, were executed, by hanging them up alive by the feet: however, the queen expired with anguish before she suffered such a cruel indignity. The king, with 50 of his chief lords, was cast into the sea, with stones about their necks. This monstrous cruelty so provoked the tyrant's soldiers, that they mutinied, and he was in no small danger of suffering for it: however, he found means to pacify them; after which he proceeded to besiege Prom, the capital of another kingdom. Here he increased his army to 900,000 men. The queen by whom it was governed offered to submit to be his vassal; but nothing would satisfy the Barma monarch less than her surrender at discretion, and putting all her treasure into his hands. This she, who knew his perfidy, refused to do: on which the city was fiercely assaulted, but greatly to the disadvantage of the Barmas, who lost near 100,000 men. However, the city was at last betrayed to him, when Mandara behaved with his usual cruelty. Two thousand children were slain, and their bodies cut in pieces and thrown to the elephants; the queen was stripped naked, publicly whipped, and then tortured, till she died; the young king was tied to her dead body, and both together cast into a river, as were also 300 other people of quality.

While the tyrant was employed in fortifying the city, he was informed, that the prince of Ava had sailed down the river Queytor with 400 rowing vessels having 30,000 soldiers on board; but that, hearing of the queen's disaster, he stopped at Meletay, a strong fortress about 12 leagues north of Prom, where he waited to be joined by his father the king of Ava with 80,000 men. On this news the Barma king sent his foster-brother Chaumigrem along the river side with 200,000 men, while he himself followed with 100,000 more. The prince, in this emergency, burnt his barks, forming a vanguard of the mariners, and, putting his small army in the best position he could, expected the enemy. A most desperate engagement ensued, in which 800 only of the prince's army were left, and 115,000 out of 200,000 Barmas who opposed him were killed. The 800 Avans retired into the fort: but Mandara coming up soon after, and being enraged at the terrible havock made in his army, attacked the fortress most violently for seven days; at the end of which time, the 800, finding themselves unable to hold out any longer, rushed out in a dark and rainy night, in order to sell their lives at as dear a rate as possible. This last effort was so extremely violent, that they broke through the enemy's troops in several places, and even pressed so hard on the king himself that he was forced to jump into the river. However, they were at last all cut off, but not before they had destroyed 12,000 of their enemies.

Mandara having thus become master of the fort, commanded it to be immediately repaired ; a
the river to the port of Ava, about a lea
capital, where he burnt between 2000 and
and lost in the enterprise about 8000 me
itself he did not think proper to invest, as
newly fortified, was defended by a numero
and an army of 80,000 men was advancing
The king also, apprehensive of Mandara's
implored the protection of the emperor of Si
to become his tributary on condition that h
sist him with his forces in recovering the ci
To this the emperor readily assented ; which
ly alarmed the Barma monarch, so that ne
ambassadors to the Kalaminbam or sovereig
territory adjacent, requesting him to divert
from his purpose. On the ambassadors retur
court, it appeared that the treaty had alread
fect ; but as the season was not yet arrived f
Ava, Chaumigrem, the king's foster-brothe
with 150,000 men to reduce Sebadi or Savad
tal of a small kingdom about 130 leagues nort
Pegu. The general, however, failed in hi
and afterwards endeavouring to revenge hi
town in the neighbourhood, he was surpris
enemy and put to flight.

In the meantime, the empire of Siam fell
distractions; the king, together, with the h
crown, were murdered by the queen, who ha
love with an officer, whom she married after
band's death. However, both of them were
killed at an entertainment ; and the crown wa
a natural brother of the late king, but a cowa
tyrant. On this Mandara resolved to invade
try ; and, his principal courtiers concurrin
scheme, he collected an army of 800,000 men
fewer than 20,000 elephants. In this army w
Portuguese, commanded by one James Suarez
ready had a pension of 200,000 ducats a-year
king of Pegu, with the title of his brother, an
nor of the kingdom. With this formidable arn
out in April 1548. His first achievement was
ing of a fortress on the borders of the enemy's
before which, being several times repulsed, an
lost 3000 of his men, he revenged himself by pu
the women to the sword. He next besieged the
itself; but though the siege was continued
months, during which time the most violent
were made upon it, the assailants were constantl
sed with great loss. However, it was still res
continue the siege ; and a mount of earth was ra
which were placed 40 pieces of cannon, ready t
it anew, when, in October, advice was received
bellion having broke out in Pegu.

The person who headed the rebels on the pres
casion was Shoripam Shay, near akin to the form
narch slain 12 years before. He was a religious
of great understanding, and esteemed a saint.
was a famous preacher, he made a sermon, in wh
set forth the tyranny of the Birmans in such a m
that he was immediately taken out of the pulpi
proclaimed king by the people, who, as a token
vereignty, gave him the title of *Shemindoo*. Th
act of sovereignty which he exerted was to cut in
15,000 Birmans, and seize on the treasure; and
greeable was this change of government to all ra

p

people, that in three weeks time all the strong holds of Pegu fell into his hands.

On this news the king immediately raised the siege in which he was engaged, and in 17 days got to Martavan. Here he was informed, that Shemindoo had posted 500,000 men in different places, in order to intercept his passage; at the same time that he had the mortification to find 50,000 of his best troops deserted. To prevent a greater desertion, after 14 days stay, he departed from Martavan, and soon met Shemindoo at the head of 600,000 men. A desperate engagement followed; in which Shemindoo was entirely defeated, with the loss of 300,000 men. Of the Birman troops were slain 60,000; among whom were 280 Portuguese.

The morning after this victory, the tyrant marched to the city: the inhabitants of which surrendered, on condition of having their lives and effects spared. The kingdom being thus again brought under his subjection, his next step was to punish the principal persons concerned in the rebellion: their heads he cut off, and confiscated their estates, which amounted to no less then ten millions of gold. Others say, that he put all without distinction to the sword, excepting only 12,000, who took shelter in James Suarez's house; that alone affording an asylum from the general slaughter. The plunder was incredible, Suarez alone getting three millions. All these cruelties, however, were insufficient to secure the allegiance of the tyrant's subjects; for in less than three months news was brought that the city of Martavan had revolted; and that the governor had not only declared for Shemindoo, but murdered 2000 Birmans. Mandara then summoned all the lords of the kingdom to meet him with their force, within 15 days, at a place called *Mouchau*, not far from his capital, whither he himself went with 300 men, to wait their arrival. But in the meantime he received intelligence that the shemin or governor of Zatan, a city of some consequence, had submitted to Shemindoo, and also lent him a large sum of gold. The shemin was immediately sent for in order to be put to death: but he, suspecting Mandara's design, excused himself by pretending sickness; after which, having consulted with his friends, he drew together about 600 men; and having with these privately advanced to the place where the king was, he killed him, with the few attendants that were about him at the time. The guards in the court being alarmed with the noise, a skirmish ensued with the shemin's men, in which about 800 were slain on both sides, most of them Birmans. The shemin then retreated to a place called *Pontel;* whither the people of the country, hearing of the death of the king, who was universally hated, resorted to him. When he had assembled about 5000 men, he returned to seek the troops which the late king had with him; and finding them dispersed in several places, easily killed them all. With the Birmans were slain 80 out of 300 Portuguese. The remainder surrendered, with Suarez their leader; and were spared, on condition of their remaining in the service of the shemin.

The shemin, now finding his forces daily increase, assumed the title of *king;* and, to render himself the more popular, gave out that he would exterminate the Birmans so effectually, as not to leave one in all the kingdom. It happened, however, that one of those who were with the late king at the time he was murdered, escaped the general slaughter; and, swimming over the river, informed Chaumigrem of the king's death. He had with him 180,000 men, all of them natives of Pegu, excepting 30,000 Barmas. He knew very well, that if the natives had known that the king was dead, he and all his Barmas would have instantly been put to the sword. Pretending, therefore, that he had received orders to put garrisons into several places, Chaumigrem dispatched all the natives into different parts; and thus got rid of those whom he had so much cause to fear. As soon as they were marched, he turned back upon the capital, and seized the king's treasure, together with all the arms and ammunition. He then set fire to the magazines, arsenals, palace, some of whose apartments were ceiled with gold, and 2000 rowing vessels which were on the river. Then destroying all the artillery, he fled with the 30,000 Barmas to his own country, being pursued in vain by the natives of Pegu.

Thus the shemin of Zatan was left in quiet possession of the kingdom; but, by his repeated acts of tyranny and cruelty, he so disgusted his subjects, that many fled to foreign countries, while others went over to Shemindoo, who began now to gather strength again. In the mean time, James Suarez, the Portuguese whom we have often mentioned, lost his life by attempting to ravish a young woman of distinction; the shemin being unable to protect him, and obliged to give him up to the mob, who stoned him to death. The shemin himself did not long survive him; for, being grown intolerable by his oppressions, most of his followers abandoned him, and he was besieged in his capital by Shemindoo with an army of 200,000 men, and soon after slain in a sally; so that Shemindoo now seemed to be fully established on the throne. But in the mean time Chaumigrem, the foster-brother to the deceased king, hearing that Pegu was very ill provided with the means of defence, invaded the kingdom with an army of 300,000 men. Shemindoo met him with three times their number; but his men, being all natives of Pegu, were inferior in strength, notwithstanding their numbers, to the enemy. The consequence was, that Shemindoo was defeated with prodigious slaughter, and Chaumigrem caused himself to be proclaimed king of Pegu. Shortly after, Shemindoo himself was taken; and, after being treated with the utmost cruelty, was beheaded.

The history of Chaumigrem is very imperfect. However, we know that he was a very great conqueror, and not at all inferior in cruelty to his predecessors. He reduced the empire of Siam and Aracan, and died in 1583; being succeeded by his son named *Pranjinoko,* then about 50 years of age. When this prince ascended the throne, the kingdom of Pegu was in its greatest height of grandeur; but by his tyranny and obstinacy he lost all that his father had gained. He died in 1599, and after his death the kingdom of Pegu became subject to Aracan. For some time past it has been tributary to the more powerful kingdom of Ava; the sovereigns of which country have hitherto been extremely cautious of permitting Europeans to obtain any settlement among them.

The air of Pegu is very healthy, and presently recovers sick strangers. The soil also is very rich and fertile in corn, rice, fruit, and roots; being enriched by the inundations of the river Pegu, which are almost incredible, extending above 30 leagues beyond its channel. It produces also good timber of several kinds. The country abounds with elephants, buffaloes, goats, hogs, and other animals, particularly game; and deer is so plenty in September and October, that one may be bought for threepence or fourpence: they are very fleshy, but have no fat. There is store of good poultry; the cocks are very large, and the hens very beautiful. As for fish, there are many sorts, and well tasted. In Pegu are found mines, not only of gold, iron, tin, and lead, a kind of copper or rather a mixture of copper and lead, but also of rubies, diamonds, and sapphires. The rubies are the best in the world; but the diamonds are small; and it is said they are sometimes found in the craws of poultry. Besides, only one family has the privilege of selling them; and none dare open the ground to dig for them. The rubies are found in a mountain in the province of Kablan, or Kapelan, between the city of Pegu and the port of Sirian.

But for a fuller account of Pegu, and the Birman empire, see Asia, from p. 740 to p. 760; and for a description of the temple of Shoemadoo, of which we have given an engraving, taken from Syme's Embassy to that kingdom, see also Asia, p. 751.

Plate CCCCVII.

PEGUNTIUM, in *Ancient Geography*, (Ptolemy); *Piguntiæ*, (Pliny); a town or citadel of Dalmatia, on the Adriatic, opposite to the island Brattia, scarcely five miles off, and 40 miles to the east of Salonæ. According to Fortis, a mountain, a large hollow, and submarine springs are seen here. "This hollow (says he) seems to have been excavated by some ancient river. The springs which bubble up from under the sea are so considerable, that they might pass for the rising again of a river sunk under ground. Vrullia has the same derivation as the word *Vril*, which in Sclavonian signifies a fountain; and this etymology, rendering the name of Vrullia, the *Berullia* of Porphyrogenitus, analogous to that of Peguntium, since Πηγυ and Vril are synonymous, induces me to believe, that the castle named Peguntium by ancient geographers was situated in this place, and not at the mouth of the Cettina. No remarkable vestiges of antiquity now exist on the spot; yet it is evident, by the quantity of fragments of vases, tiles, and sepulchral inscriptions now and then dug up, that this tract of coast was well inhabited in the Roman times. The principal cause why the traces of ancient habitations cannot be discovered about Vrullia, is the steepness of the hill above it, and the quantity of stones brought down from thence by the waters. The mouth of the hollow of Vrullia is dreaded by seamen, on account of the sudden impetuous gusts of wind that blow from thence, and in a moment raise a kind of hurricane in the channel between the Primorie and the island of Brazza, to the great danger of barks surprised by it."

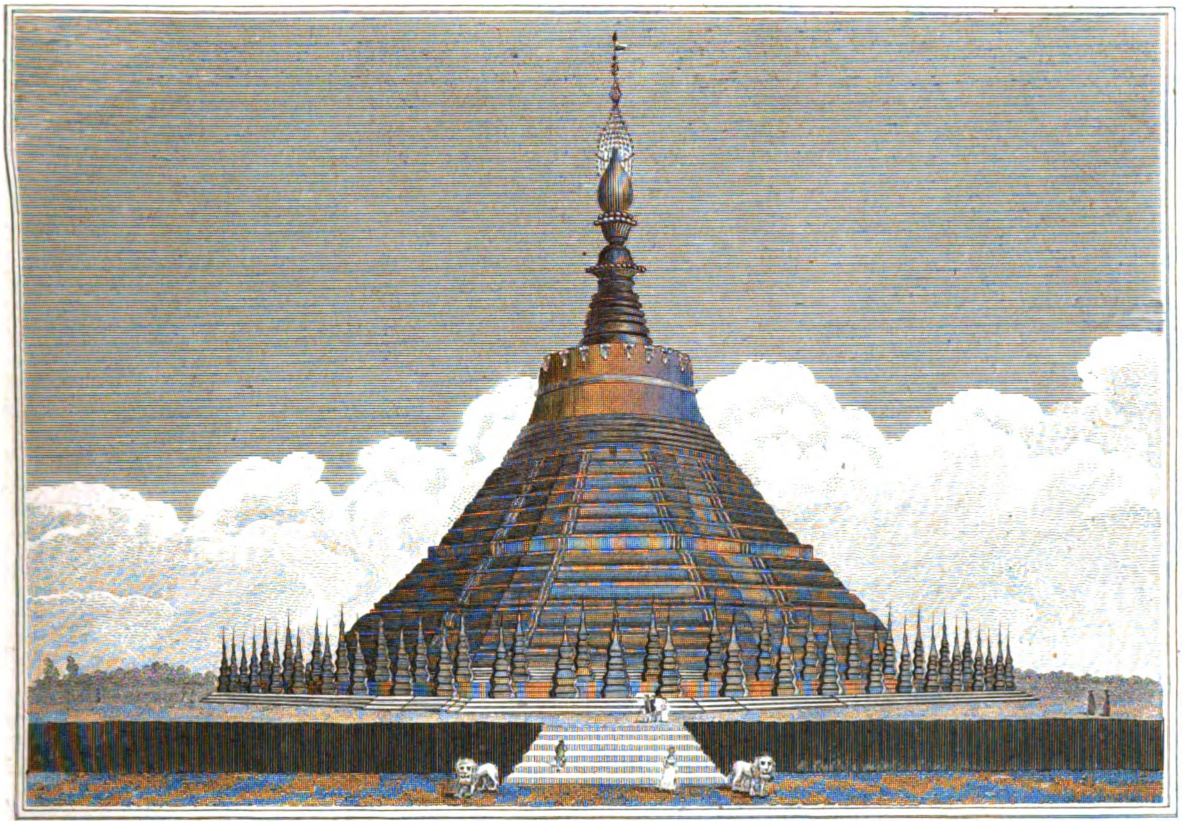
Travels into Dalmatia.

PEINE forte et dure, (Lat. *pœna fortis et dura*), signifies a special punishment inflicted on those who, being arraigned of felony, refuse to put themselves on the ordinary trial, but stubbornly stand mute; it is vulgarly called *pressing to death*. See Arraignment.

PEIRCE, James, an eminent dissenting minister, was born at Wapping, in London, in the year 1674, and was educated at Utrecht and Leyden; after which he spent some time at Oxford, in order to enjoy the benefit of frequenting the Bodleian library. He then for two years preached the Sunday-evening's l
meeting-house in Miles-Lane, London, and
at Cambridge. In 1713 he was removed
gation at Exeter, where he continued till the
when the Calvinists among the dissenters
subscription to articles of faith to be signe
dissenting ministers in the kindom, several a
proposed to him and Mr John Hallet, anothe
minister at Exeter, in order to their subscr
they both refused, imagining this proceedi
dissenting brethren to be an unworthy impos
ligious liberty and private judgment; and fo
were ejected from their congregation. Upon
meeting was opened for them at Exeter, of
Peirce continued minister till his death, in 1
was a man of the strictest virtue, exemplary
great learning. He wrote, 1. *Exercitatio p
de Homœmeria Anaxagorea.* 2. Thirteen pie
Controversy between the Church of Englan
Dissenters. 3. Ten pieces on the Controversy
Ejectment at Exeter. 4. Six pieces on the D
the Trinity. 5. A Paraphrase and Notes on
tles of St Paul to the Colossians, Philippians,
brews. 6. An Essay in favour of giving the
to Children. 7. Fourteen Sermons.

PEIRESC, Nicolas Claude Fabri, bor
was descended from an ancient and noble fami
originally at Pisa in Italy. At ten years of ag
sent to Avignon, where he spent five years in th
college, in the study of what in Scotland an
Continent is called *humanity*. From Avignon
in 1595, removed to Aix, and entered upon t
of philosophy. In the interim, he attended th
masters for dancing, riding, and handling arms
which, though he performed the lessons regularl
with reluctance: for this being done only to p
uncle, whose heir he was to be, he never prac
himself, esteeming all the time lost that was n
in the pursuits of literature. During this period
ther being presented with a medal of the empero
dius, which was found at Belgenser, Peiresc beg
favour of it; and, charmed with deciphering th
racters in the exergue, and reading the emperor's
he carried the medal with a transport of joy to his
who for his encouragement gave him two more
ther with some books upon the subject. This
epoch of his application to antiquities, for which
came afterwards so famous. In 1596, he was s
finish his course of philosophy under the Jesuits at
non, where he turned his attention particularly t
mography, as being necessary to the understand
history, abating, however, nothing of his applicat
antiquity, in which he was assisted by Petrus Ro
one of the professors, and a skilful medalist: nor
omit the study of humanity in general, wherein h
the master and instructor of a brother who was with
But to do all this he was obliged to sit up late at ni
and so much labour and attention, as he was natu
of a tender constitution, increased the weakness o
stomach formerly contracted, and for which he had
a kind of digestive powder. Being recalled by
uncle in 1597, he returned to Aix, and entered t
upon the study of the law; which he prosecuted, h
ever, so as to find leisure to visit and converse frequ

the great Temple at Pegue.



The Geometrical Pen

Fig. 2.

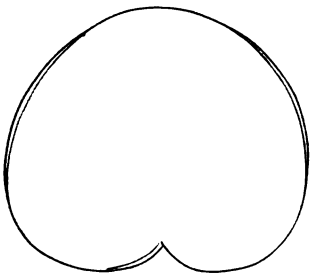


Fig. 3.

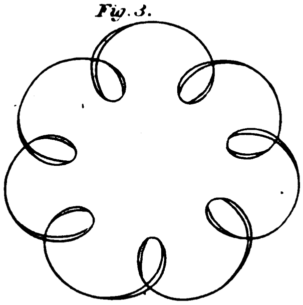


Fig. 4.

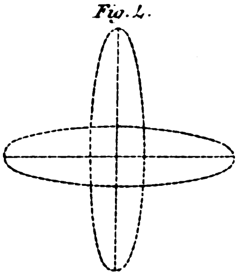
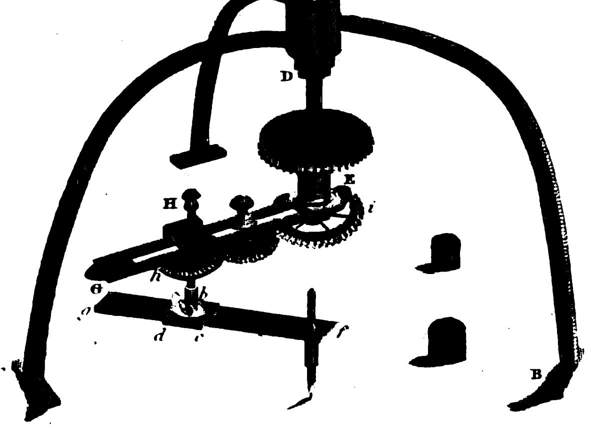


Fig. 1.



The Fountain Pen.

Fig. 3.

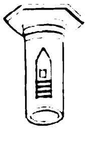


Fig. 2.

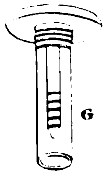
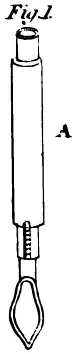


Fig. 1.



Engraved by W. & D. Lizars Edin^r

ly with Peter A. R. Bagarr, a most skilful antiquary, who was afterwards made master of the jewels to Henry IV.

The following year he went again to Avignon, to carry on his course of law under one Peter David: who being well skilled likewise in antiquities, was pleased to see Peiresc join this study to that of the law. But Ghibertus of Naples, auditor to Cardinal Aquaviva, fed his curiosity the most, in showing him some rarities, such as he had never seen before. Ghibertus also lent him Goltzius's Treatise upon Coins, and advised him to go into Italy, especially to Rome; where he would meet with curiosities to satisfy his most ardent wishes. Accordingly, his uncle having procured a proper governor, he and his brother set out upon that tour September 1599; and passing through Florence, Bononia, and Ferrara, when he had staid a few days at Venice, he fixed his residence at Padua, in order to complete his course of law. But once a quarter, going to Venice to get cash for bills of exchange, he took these opportunities of introducing himself to the most distinguished literati there; and was particularly caressed by F. Contarin, procurator of St Mark, who was possessed of a curious cabinet of medals, and other antiquities, without knowing the value of them. This was fully shown to him by Peiresc, who likewise explained the Greek inscriptions upon his medals, and the monumental stones. After a year's stay at Padua, he set out for Rome, and arrived there October 1600, in order to be in time for seeing the jubilee; to celebrate which, the Porta Sancta would be opened in the beginning of the next year. He passed six months in this city, viewing the numberless curiosities there, and in cultivating the friendship of Galileo, by whom he was much beloved. This friendship led him to carry his researches into astronomy and natural philosophy; and he was present when Fabricius ab Aquapendente, out of a parcel of eggs upon which a hen was sitting, took one every day, to observe the gradual formation of the chick from first to last. From this time it was generally acknowledged, that he had taken the helm of learning into his hand, and began to guide the commonwealth of letters.

Having now spent almost three years in Italy, he began to prepare for his departure: and in the end of 1602, having packed up all the rarities, gems, &c. which he had procured, and put them into the road to Marseilles, he left Padua, and crossing the Alps of Geneva, went to Lyons; where receiving money he made a handsome present to his governor, who took the route of Paris. From Lyons he went to Montpelier, to improve himself in the law under Julius Parius. From Montpelier he dispatched more rarieties to his uncle, who sending for him home, he arrived at Aix in November; but, bringing Parius along with him, he obtained leave to return to Montpelier in a few days. He waited upon Parius back again, under whom he continued pursuing his law studies till the end of 1603, when he returned to Aix, at the earnest request of his uncle, who, having resigned to him his senatorial dignity, had ever since the beginning of the year laboured to get the king's patent. The degree of doctor of law was a necessary qualification for that dignity. Peiresc, therefore, having kept the usual exercise, took that degree Jan. 18. 1604, when the aforesaid patent was given in to the senate, and ordered to be recorded: yet Peiresc procured leave not to be presently entered into the list of senators. The bent of his inclination was not so much to business as to advance arts and sciences, and to assist all the promoters of learning. For this purpose, he resolved to lead a single life; so that when his father had concluded a match for him with a respectable lady, he begged to be excused.

In 1605, he accompanied G. Varius, first president of the senate at Aix, who was very fond of him, to Paris: whence, having visited every thing curious, he crossed the water, in company with the king's ambassador, 1606, to England. Here he was very graciously received by King James I.; and having seen Oxford, and visited Camden, Sir Robert Cotton, Sir Henry Saville, and other learned men, he passed over to Holland; and after visiting the several towns and universities, with the literati in each, he went through Antwerp to Brussels, and thence back to Paris, to see the ceremony of the Dauphin's baptism; which being solemnized August 24. he returned home in September 1606, being expected for the ordering of the family affairs.

Presently after this, he purchased the barony of Rians; and at the solicitation of his uncle, having approved himself before that assembly, he was received a senator on the 1st of July 1607. January 1608 he lost his uncle; and the following year, falling himself into a dangerous fever, recovered by eating musk-melons before supper, for which he had conceived a longing. He was ordered by his physician to eat them before his meals without bread, and to drink a glass of pure wine upon them. He continued this method all his life afterwards: and grew so fond of them, that, though he could abstain from any other meat as he listed, yet towards them he professed he was unable to master himself. He frequently experienced, that in the musk-melon season he was never troubled with the gravel. In 1618, having procured a faithful copy of "the Acts of the Monastery of Maren in Switzerland," he published a second edition of that work. As it was written in defence of the royal line of France against Theodoric Piespordius, who had attempted to prove the title of the Austrian family to the French crown by right of succession, he was, upon this publication, nominated the same year, by Louis XIII. abbot of Sancta Maria Aquistriensis. He stayed in France till 1623; when, upon a message from his father, now grown old and sickly, he left Paris, where he had spent seven years and some months. He arrived at Aix in October; and not long after presented to the court a patent from the king, permitting him to continue in the function of his ancient dignity, and to exercise the office of a secular or lay person, notwithstanding that, being an abbot, he had assumed the character of a churchman. To this the court of parliament not assenting, decreed unanimously, that, being already admitted into the first rank, he should abide perpetually therein; not returning, as the custom of the court was, to the inferior auditory, wherein trials are usually had of criminal cases. In 1625, he buried his father, who had been long afflicted with the gout. In 1627, he prevailed with the archbishop of Aix to establish a post thence to Lyons, and so to Paris and all Europe; by which the correspondence constantly held with the literati everywhere was much facilitated. In 1629, he began to be much tormented with the strangury and hæmorrhoides; and in 1631, having completed the marriage of his nephew Claudius with Margaret Alresia, a noblewoman of the county of Avignon, he bestowed upon him the barony of Rianty, together with a grant of his senatorial dignity, only reserving the function to himself for three years. But the parliament not waiting his surrendry of it, he resented that affront so heinously, that he procured, in 1635, letters patent from the king to be restored, and to exercise the office for five years longer, which happened to be till his death: for being seized, June 1637, with a fever that brought on a stoppage of urine, this put an end to his life on the 24th of that month, in his 57th year.

The character of Peiresc may be summoned up in a few words. His person was of a middle size, and of a thin habit: his forehead large, and his eyes gray; a little hawk nosed; his cheeks tempered with red; the hair of his head yellow, as also his beard, which he used to wear long; his whole countenance bearing the marks of uncommon and rare courtesy and affability. In his diet he affected cleanliness, and in all things about him; but nothing superfluous or costly. His clothes were suitable to his dignity; yet he never wore silk. In like manner, the rest of his house was adorned according to his condition, and very well furnished; but he neglected his own chamber. Instead of tapestry, there hung the pictures of his chief friends and of famous men, besides innumerable bundles of commentaries, transcripts, notes, collections from books, epistles, and such like papers. His bed was exceedingly plain, and his table continually loaded and covered with papers, books, letters, and other things; as also all the seats round about, and the greatest part of the floor. These were so many evidences of the turn of his mind; in respect to which, the writer of his euloge compares him to the Roman Atticus; and Bayle, considering his universal correspondence and general assistance to all the literati in Europe, dashed it out luckily enough, when he called him "the attorney general of the literary republic." The works which he published are, "Historia provinciæ Galliæ Narbonensis;" "Nobilium ejusdem provinciæ familiarum Origines, et separatim Fabriciæ;" "Commentarii rerum omnium memoria dignarum sua ætate gestarum; "Liber de ludicris naturæ operibus;" "Mathematica et astronomica varia;" "Observationes mathematicæ;" "Epistolæ ad S. P. Urbanum VIII. cardinales Barberinos, &c.;" "Authores antiqui Græci et Latini de ponderibus et mensuris;" "Elogia et epitaphia;" "Inscriptiones antiquæ et novæ;" "Genealogia domus Austriacæ;" "Catalogus librorum biblioth. reg.;" "Poemata varia;" "Nummi Gallici, Saxonici, Britannici, &c.;" "Linguæ orientales, Hebræa, Samaritana, Arabica, Egyptiaca, et Indices librorum harum linguarum;" "Observationes in varios auctores." It is remarkable, that though Peiresc bought more books than any man of his time, yet his collection left was not large. The reason was, that as fast as he purchased, he kept continually making presents of them to such learned men as he knew they would be useful to.

Gassendi's Life of Peiresc in English, Lond. 1657.

PEKIN, the capital city of the empire of China, in Asia, where the emperor generally resides. It is situated in a very fertile plain, 20 leagues distant from the great wall. This name, which signifies the *northern*
court, is given to it, to distinguish it from a
siderable city called *Nanking*, or the *sout*
The emperor formerly resided in the latte
Tartars, a restless and warlike people, ol
prince to remove his court to the northern
that he might more effectually repel the in
those barbarians, by opposing to them a nun
litia which he generally keeps around his p
is an exact square, and divided into two part
that which contains the emperor's palace, w
the new city, or, as it is called, the Tartar
cause it is inhabited by Tartars ever since the
ed this empire; the other, called the *Old City*,
ted by the Chinese. The city is surrounded b
wall rather less than thirty feet high, and
round a circumference of 14 English miles. T
ings within, according to Mr Barrow, are so
be completely hidden by the wall. They are
structed on the model of a tent, being supp
slight wooden pillars, and concealed by a de
wall to the street; their roofs alone appear al
enclosure, and being arranged in straight lines
out the whole city, gives it very much the app
of a vast encampment. With the exception of
great streets which lead to the gates, the res
city consists of very narrow lanes, and every pa
is entirely without pavement, and filled with
dust. There are no aqueducts, and the well w
is generally nauseous. There are no drains;
substances that may be used as manure, being k
the house, the whole precincts are infected with
fensive odour. The buildings are generally mea
cept one or two temples. The population of Pek
been estimated at 2,000,000, but Sir George St
thinks it cannot be less than 3,000,000. Th
coup d'oeil of the great streets is singular and str
"The multitude of moveable workshops," says M
row, "of tinkers and barbers, coblers and blacksn
the tents and booths where tea and fruit, rice and
eatables, were exposed for sale, with the wares
merchandise arrayed before the doors, had contr
the spacious street to a narrow road in the middle
wide enough for two of our little vehicles to pass
other. The cavalcade of officers and soldiers that
ceded the embassy; the processions of men in office
tended by their numerous retinues, bearing umbre
and flags, and painted lanterns, and a variety of str
insignia of their rank and station; different trains
were accompanying with lamentable cries corpse
their graves, and with squalling music, brides to t
husbands; the troops of dromedaries laden with c
from Tartary, the wheelbarrows and handcarts stu
with vegetables, occupied nearly the whole of this m
dle space in one continued line, leaving very lit
room for the cavalcade of the embassy to pass.
was in motion. The sides of the street were filled w
an immense concourse of people buying and selling, a
bartering their different commodities. The buzz a
confused noises of this mixed multitude, proceedi
from the loud bawling of those who were crying the
wares, the wrangling of others, with every now a
then a strange twanging noise like the jarring of
cracked Jews harp, the barber's signal made by h
tweezers, the mirth and laughter that prevailed i
every group, could scarcely be exceeded by the broke

in the Bank rotunda, or the Jews and old women in Rosemary lane. Pedlars with their packs, and jugglers, and conjurers, fortune-tellers, mountebanks, quack-doctors, comedians and musicians, left no space unoccupied."

Grosier's Description of China.

"People of distinction, says Grosier, oblige all their dependents to follow them. A mandarin of the first rank is always accompanied in his walks by his whole tribunal; and, to augment his equipage, each of the inferior mandarins in his suit is generally attended by several domestics. The nobility of the court, and princes of the blood, never appear in public without being surrounded by a large body of cavalry; and, as their presence is required at the palace every day, their train alone would be sufficient to create confusion in the city. It is very singular, that in all this prodigious concourse no women are ever seen; hence we may judge how great the population of China must be, since the number of females in this country, as well as everywhere else, is superior to that of the other sex.

"As there is a continual influx of the riches and merchandize of the whole empire into this city, the number of strangers that resort hither is immense. They are carried in chairs, or ride on horseback; the latter is more common: but they are always attended by a guide, acquainted with the streets, and who knows the houses of the nobility and principal people of the city. They are also provided with a book, containing an account of the different quarters, squares, remarkable places, and of the residence of those in publice offices. In summer there are to be seen small temporary shops, where people are served with water cooled by means of ice; and one finds everywhere eating-houses, with refreshments of tea and fruits. Each kind of provision has a certain day and place appointed for its being exposed to sale.

"The governor of Pekin, who is a Mantchew Tartar, is styled Governor of the Nine Gates. His jurisdiction extends not only over the soldiers, but also over the people in every thing that concerns the police. No police can be more active; and it is surprising to see, among an infinite number of Tartars and Chinese mixed together, the greatest tranquillity prevail. It is rare, in a number of years, to hear of houses being robbed, or people assassinated. All the principal streets have guard rooms, and soldiers patrole night and day, each having a sabre hanging from his girdle, and a whip in his hand, to correct, without distinction, those who excite quarrels or cause disorder. The lanes are guarded in the same manner; and have latticed gates, which do not prevent those from being seen who walk in them: they are always kept shut during the night, and seldom opened even to those who are known; if they are, the person to whom this indulgence is granted, must carry a lanthorn, and give a sufficient reason for his going out. In the evening, as soon as the soldiers are wanted to their quarters by beat of drum, two centinels go and come from one guard-room to another, making a continual noise with a kind of castanet, to show that they are not asleep. They permit no one to walk abroad in the night-time. They even examine those whom the emperor despatches on business; and if their reply gives the least cause of suspicion, they have a right to convey them to the guard-room. The soldiers in each of the guard-rooms are obliged to answer every time the centinels on duty call out.

"It is by these wise regulations, observed with the greatest strictness, that peace, silence, and safety reign throughout the whole city. The governor is also obliged to go the round; and the officers stationed on the walls, and in the towers over the gates (in which are kept large kettle-drums that are beat every time the guard is relieved), are continually dispatching subalterns to examine the quarters belonging to the gates where they are posted. The least neglect is punished next morning, and the officer who was on guard is cashiered. The support of this police costs the emperor a great deal; for part of the soldiers we have mentioned are maintained for this purpose only. They are all infantry, and their pay is generally very high.

The walls of the emperor's palace, including that and the gardens, are about two miles in length. "Although (says Grosier) the Chinese architecture has no resemblance to that of Europe, the imperial palace of Pekin does not fail to strike beholders by its extent, grandeur, and the regular disposition of its apartments, and by the singular structure of its pavilion-roofs, ornamented at each corner with a carved plat-band, the lower extremity of which is turned upwards. These roofs are covered with varnished tiles of so beautiful a yellow colour, that at a distance, they make as splendid an appearance as if they were gilded. Below the upper roof there is another of equal brilliancy, which hangs sloping from the wall, supported by a great number of beams, daubed over with green varnish, and interspersed with gilt figures. The second roof, with the projection of the first, forms a kind of crown to the whole edifice. The palace is a small distance from the south gate of the Tartar city. The entrance to it is through a spacious court, to which there is a descent by a marble staircase, ornamented with two large copper lions, and a balustrade of white marble. This balustrade runs in the form of a horse-shoe, along the banks of the rivulet, that winds across the palace with a serpentine course, the bridges over which are of marble. At the bottom of this first court arises a façade with three doors: that in the middle is for the emperor only; the mandarins and nobles pass through those on each side. These doors conduct to a second court, which is the largest of the palace: it is about 300 feet in length, and 50 in breadth. An immense gallery runs round it, in which are magazines, containing rich effects, which belong to the emperor as his private property; for the public treasure is entrusted to a sovereign tribunal called *Hou-pou*. The first of these magazines is filled with plate and vessels of different metals; the second contains the finest kinds of furs; the third, dresses lined with sable, ermine, minever, and foxes skins, which the emperor sometimes gives in presents to his officers; the fourth is the depository of jewels, pieces of curious marble, and pearls fished up in Tartary; the fifth, consisting of two stories, is full of wardrobes and trunks, which contain the silk stuffs used by the emperor and his family; the rest are filled with bows, arrows, and other pieces of armour taken from the enemy or presented by different princes.

"The royal hall, called *Tai-hotien*, or the Hall of the

Pekin.

the Grand Union, is in this second court. It is built upon a terrace about 18 feet in height, incrusted with white marble, and ornamented with balustrades of excellent workmanship. Before this hall all the mandarins range themselves, when they go, on certain days, to renew their homage, and perform those ceremonies that are appointed by the laws of the empire. This hall is almost square, and about 130 feet in length. The ceiling is carved, varnished green, and loaded with gilt dragons. The pillars which support the roof within are six feet in circumference towards the base, and are coated with a kind of mastich varnished red; the floor is partly covered with coarse carpets, after the Turkish manner; but the walls have no kind of ornament, neither tapestry, lustres, nor paintings.

"The throne, which is in the middle of the hall, consists of a pretty high alcove, exceedingly neat. It has no inscription but the character *ching*, which the authors of this relation have interpreted by the word *holy*: but it has not always this signification; for it answers better sometimes to the Latin word *eximius*, or the English words *excellent*, *perfect*, *most wise*. Upon the platform opposite to this hall stand large vessels of bronze, in which incense is burnt when any ceremony is performing. There are also chandeliers shaped like birds and painted different colours, as well as the wax-candles that are lighted up in them. This platform is extended towards the north, and has on it two lesser halls; one of them is a rotunda that glitters with varnish, and is lighted by a number of windows. It is here that the emperor changes his dress before or after any ceremony. The other is a saloon, the door of which opens to the north: through this door the emperor must pass, when he goes from his apartment to receive on his throne the homage of the nobility; he is then carried in a chair, by officers dressed in long red robes bordered with silk, and caps ornamented with plumes of feathers. It would be difficult to give an exact description of the interior apartments which properly form the palace of the emperor, and are set apart for the use of his family. Few are permitted to enter them but women and eunuchs."

The temples and the towers of this city are so numerous, that it is difficult to count them. Provisions of all kinds are very plentiful, they being, as well as the merchandises, brought from other parts by means of canals cut from the rivers, and always crowded with vessels of different sizes, as well as from the adjacent country. An earthquake which happened here in 1731 buried above 100,000 persons in the ruins of the houses which were thrown down. E. Long. 116. 41. N. Lat. 39. 54. See CHINA, SUPPLEMENT.

We have already, under the article OBSERVATORY, mentioned the famous observatory in this city, of which we shall give this further account from the Universal History. "The Chinese had thought nothing in the universe could equal in magnificence this famous place; and one of the most celebrated mathematicians of the royal academy of Paris hath made no scruple to represent it as one of the greatest prodigies of art and ingenuity, of beauty and magnificence; and yet, when

Mod. Un. Hist. vol. viii.

this celebrated structure came to be view
proper and unbiassed judges, it appears to
of little worth as to its ancient machines,
to its situation; and that all that is now va
is owing to the improvements made by Fath
a Flemish Jesuit, who caused a new set of i
to be made, with extraordinary care, neatnes
cision.

"This fabric stands in a court of a moder
and is built in the form of a square tower,
to the city wall on the inside, and raised
twelve feet above its bulwark. The ascent
top is by a very narrow staircase; and on th
above were placed all the old instruments, whi
but few, took up the whole room, till Fathe
introduced his new apparatus, which he dis
more convenient order. These are large,
and embellished; and were the neatness of th
answerable to the work, and the telescopes f
them according to the new method, they
equal to those of Europe; but the Chinese
were, it seems, either too negligent, or inc
following his directions. As to the old ins
they were, by order of the emperor Kang-hi,
as useless, and laid in the hall near the towe
they may be seen through a cross-barred win
covered with rust, and buried in oblivion.

"In this famed observatory there are five m
ticians employed night and day, each in a prope
ment on the top of the tower, to observe all tha
over their heads: Their observations are caref
tered in their journals, and an account of them is
every morning to the surveyor of the mathemati
registered in his office." These mathematician
ever, are very ignorant. Mr Barrow tells us th
compiled the national calendar from the *Conna*
de tems of Paris, and that journal not having
in consequence of the war, they were in great perp
till one of the gentlemen belonging to the embas
nished them with a set of nautical almanacs
1800.

PELAGIANS, a Christian sect who ap
about the fifth or end of the fourth century.
maintained the following doctrines: 1. That Ada
by nature mortal, and, whether he had sinned o
would certainly have died. 2. That the consequ
of Adam's sin were confined to his own person. 3.
new-born infants are in the same situation with
before the fall. 4. That the law qualified men fo
kingdom of heaven, and was founded upon
promises with the gospel. 5. That the general r
rection of the dead does not follow in virtue o
Saviour's resurrection. 6. That the grace of G
given according to our merits. 7. That this gra
not granted for the performance of every moral
the liberty of the will, and information in poin
duty, being sufficient, &c. The founder of this sect

PELAGIUS, a native of Great Britain; but w
ther of England, Scotland, or Wales, is as uncertai
it is immaterial (A). He was born towards the c
of the fourth century, and educated in the monast

(A) Dr Henry thinks he was born in North Wales; that his real name was Morgan, of which Pelag of Banchor, in Wales, of which he became a monk, and afterwards abbot. In the early part of his life he went over to France, and thence to Rome, where he had the insolence to promulgate certain opinions somewhat different from those of the infallible church. His morals being irreproachable, he gained many disciples; and the dreadful heresy made so rapid a progress, that, for the salvation of souls, it became necessary for the pope to exert his power. Pelagius, to avoid the danger, in the year 409 passed over to Sicily, attended by his friend and pupil Celestius. In 411 they landed in Africa, continued some time at Hippo, and were present at the famous conference between the Catholics and Donatists which was held at Carthage in 412. From thence they travelled into Egypt; and from Egypt, in 415, to Palestine, where they were graciously received by John bishop of Jerusalem. In the same year Pelagius was cited to appear before a council of seventeen bishops, held at Diospolis. They were satisfied with his creed, and absolved him of heresy. The African bishops, however, being displeased with their proceedings, appealed to the Roman pontiff: he first approved, and afterwards condemned, the opinions of Pelagius, who, with his pupil Celestius, was publicly excommunicated; and all the bishops who refused to subscribe the condemnation of the Pelagian heresy were immediately deprived. What became of him after this period is entirely unknown; but it seems very probable that he retired to Banchor, and died abbot of that monastery. He wrote, 1. *Expositionum in epist. Paulinas*, lib. xiv. 2. *Epistola ad Demetriadem de virginitate*. 3. *Explanationis symboli ad Damasum*. 4. *Epistolæ ad viduam duæ*. 5. *De libero arbitrio*. These and many other fragments are scattered among the works of St Jerome. They are also collected by Garnerius, and published in Append. op. Mercatoris, p. 373. *Cave*.

PELAGOSA, an island in the Adriatic, which, together with several rocks that appear above water near it, are the remains of an ancient volcano. "I will not assure you (says Fortis) that it was thrown up out of the sea like several other islands in the Archipelago, though there is some ground to suspect this to have been the case; because we find no precise mention of it in the most ancient geographers. It should seem that it ought not to be confused with the Diomedes, from which it is 30 miles distant; yet it is not impossible that they have reckoned it among them. The lava which forms the substance of this island, is perfectly like the ordinary lava of Vesuvius, as far as I could discover in passing near it. If a naturalist should land there, and visit on purpose the highest parts of the island, perhaps we might then know whether it has been thrown up by a submarine

Travels into Dalmatia.

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is a translation; and that he was born on the 13th of November A. D. 354, the same day with his great antagonist St Augustin. The same learned historian gives us the following account of Pelagius and his great coadjutor Celestius. "He received a learned education in his own country, most probably in the great monastery of Banchor near Chester, to the government of which he was advanced A. D. 404. He was long esteemed and loved by St Jerome and St Augustin, who kept up a friendly correspondence with him by letters before they discovered the heretical pravity of his opinions; for Pelagius, being a cautious and artful man, for some time vented his peculiar notions as the sentiments of others, without discovering that they were his own. At length, however, he threw off the mask, and openly published and defended his doctrines at Rome about the beginning of the fifth century. This involved him in many troubles, and drew upon him the indignation of his former friends St Jerome and St Augustin, who wrote against him with great acrimony. He is acknowledged, even by his adversaries, to have been a man of good sense and great learning, and an acute disputant, though they load him with the most bitter reproaches for his abuse of these talents. His personal blemishes are painted in very strong colours; and he is represented by these good fathers, in the heat of their zeal, as a very ugly fellow, 'broad-shouldered, thick-necked, fat-headed, lame of a leg, and blind of an eye.' Even the most northern parts of this island (Britain) produced some men of learning in this period. Celestius, the disciple and friend of Pelagius, was a Scotsman, who made a prodigious noise in the world by his writings and disputations about the beginning of the fifth century. He defended and propagated the peculiar opinions of his master Pelagius with so much learning, zeal, and success, that those who embraced these opinions were frequently called Celestins. Before he became acquainted with these doctrines he wrote several books, which were universally admired for their orthodoxy, learning, and virtuous tendency. After he had spent his youth in his own country in a studious privacy, he travelled for his further improvement to Rome, where he became acquainted with Rufinus and Pelagius, and was by them infected with their heresies. From that time he became the most indefatigable and undaunted champion of these heresies, and thereby brought upon himself the indignation of the orthodox fathers of these days, who gave him many very bad names in their writings. St Jerome, whose commentaries on the Ephesians he had presumed to criticise, calls him, 'an ignorant, stupid fool, having his belly swelled and distended with Scots pottage; a great, corpulent, barking dog, who was fitter to kick with heels than to bite with his teeth; a Cerberus, who, with his master Pluto (Pelagius), deserved to be knocked on the head, that they might be put to eternal silence.' Such were the flowers of rhetoric which these good fathers employed against the enemies of the orthodox faith! But candour obliges us to observe, that this was perhaps more the vice of the age in which they lived than of the men. Both Pelagius and Celestius were very great travellers; having visited many different countries of Asia and Africa, as well as Europe, with a view to elude the persecutions of their enemies, and to propagate their opinions. It is no inconsiderable evidence of their superior learning and abilities, that their opinions gained great ground in all the provinces both of the eastern and western empire, in spite of the writings of many learned fathers, and the decrees of many councils against them. 'The Pelagian and Celestian heresy (says Photius) not only flourished in great vigour in the West, but was also propagated into the East.'

rine volcano, as the island near Santerini was in our age; or if we ought to believe it the top of some ancient volcanic mountain, of which the roots and sides have been covered by the waters, which divided Africa from Spain, forming the straits of Gibraltar; an invasion that no one can doubt of who has examined the bottoms and shores of our sea. The Lissan fishermen say, that Pelagosa is subject to frequent and violent earthquakes; and the aspect of the island proves at first sight, that it has suffered many revolutions; for it is rugged, ruinous, and subverted."

PELAIAH, a Levite (Nehem. viii. 7. x. 10.). He was one of the principal Levites that returned from captivity, and was one of those who signed the covenant that Nehemiah renewed with the Lord.

PELALIAH, son of Amazi and father of Jeroham, of the family of Pashur son of Malchiah, of all whom mention has been made: he was of the race of the priests (Nehem. xi. 12.).

PELASGI. See PELASGIOTIS.

PELASGIA (Pliny); the ancient name of *Lesbos;* so called from the Pelasgi, its first inhabitants (Diodorus Siculus). Also the ancient name of *Peloponnesus,* from Pelasgius, a native of the country (Nicolaus Damascenus, Ephorus).

PELASGICUM (Pausanias, Pliny); the north wall of Athens; so called from the builders, the Pelasgi. There was an execration pronounced on any that should build houses under this wall, because the Pelasgi, while dwelling there, entered into a conspiracy against the Athenians (Thucydides).

PELASGIOTIS, a third part of Thessaly (Strabo; so called from a very ancient people, the Pelasgi, called *Pelasgiotæ* (Ptolemy); who formerly, together with the Æolians, occupied Thessaly, and thence that part was called *Pelasgicum Argos;* besides many other parts of Greece. Their name *Pelasgi,* or *Pelargi,* denoting storks, was given them from their wandering roving life (Strabo). The poets extend the appellation to Greeks in general. *Pelasgus,* the epithet. Some of the inhabitants of Crete were called *Pelasgi* (Homer); who thus also calls the neighbouring people to the Cilicians in Troas. The Pelasgi were originally of Arcadia, (Hesiod); but Æschylus makes Argos, near Mycenæ, their country. The Pelasgiotis was situated between Pieria and Macedonia to the north and west, Thessaliotis to the south, and Magnesia to the east, (Strabo, Pliny).

PELATÆ, were free-born citizens, among the Athenians, who by poverty were reduced to the necessity of serving for wages. During their servitude they had no vote in the management of public affairs, as having no estate to qualify them; but this restriction was removed whenever they had released themselves from their servile situation, which they were allowed to do when able to support themselves. While they continued servants, they had also a right to change their masters. We find them sometimes distinguished by the name of *Thetæ.*

PELATIAH, son of Hananiah, and father of Ishi, of the tribe of Simeon. He subdued the Amalekites upon the mountain of Seir (1 Chron. iv. 42.). The time of this action is unknown.

PELATIAH, son of Benaiah, a prince of the people, who lived in the time of Zedekiah king of Judah, and opposed the wholesome advice given by Jeremiah, to submit to King Nebuchadnezzar. Ezekiel (xi. 1, 2, 3, 4.) being a captive in Mesopotamia, had a vision, in which he saw five and twenty men at the door of the temple of Jerusalem, among whom were Jaazaniah the son of Azur, and Pelatiah the son of Benaiah, who were the most remarkable. Then the Lord said to him, "Son of man, these are the men that have thoughts of iniquity, and who are forming pernicious designs against this city, saying, Have not the houses been built a long time? Jerusalem is the pot, and we are the flesh. Thus saith the Lord: You have made great havock in this city, and have filled its streets with dead bodies. These men are the flesh, and the city is the pot. But as for you, I will make you come forth from the middle of this city, and I will make you perish by the hands of your enemies." As he was prophesying in this manner, Pelatiah the son of Benaiah died.

PELE, (Stephanus). There were two towns of this name in Thessaly; the one subject to Eurypylus, the other to Achilles; both extinct. *Peleus* the gentilitious name (*id.*).

PELEG, son of Eber, was born in the year of the world 1757. The scripture says his father gave him the name of Peleg, signifying division, because in his time the earth began to be divided (Gen. xi. 16. x. 25.); whether it was that Noah had begun to distribute the earth among his descendants, some years before the building of Babel; or that Peleg came into the world the same year that Babel was begun, and at the division of languages; or that Eber by a spirit of prophecy gave his son the name of *Peleg* some years before the tower of Babel was begun, is not absolutely certain. That which here perplexes the interpreters is, first, that Peleg came into the world not above 100 years after the deluge. But it should seem, that the number of men was not then sufficient for such an undertaking as that of Babel. Secondly, Joktan the brother of Peleg had already thirteen sons at the time of this dispersion, which happened after the confusion of Babel (Gen. x. 26, 27, 28, &c.). Peleg being born in the thirty-fourth year of Eber (Gen. xi. 16.), it is impossible his brother Joktan should have such a number of children at the birth of Peleg. It seems therefore that he was not born at the time of the dispersion. To this may be answered, that Moses has there enumerated the names of the thirteen sons of Joktan (in Gen. x. 26.) by way of anticipation, though they were not born till a good while after the confusion at Babel; but as they possessed a very large country, it was convenient to take notice of them, and to name them among the other descendants of Noah, who divided the provinces of the east among themselves. However this may have been, at the age of thirty years Peleg begat Reu; and he died at the age of 239.

PELETHITES. The Pelethites and Cherethites were famous under the reign of King David. They were the most valiant men in the army of that prince, and had the guard of his person. See Ezekiel xxv. 16. Zephaniah ii. 5. 1 Sam. xxx. 14. 2 Samuel xv. 18. xx. 7. *Patrick's Comm. Pool's Annot.* and *Delany's Hist. of the Life of David.*

PELETHRONII, a name or epithet given to the Lapithæ, either because they inhabited the town of Pelethronium at the foot of Mount Pelion in Thessaly, or because one of their number bore the name of *Pelethronius.* It is to them, we are told, that mankind are indebted for the invention of the bit with which they tamed their horses with so much dexterity.

PELETHRONIUM (Nicander and Scholiast); a town of Thessaly, situated in a flowery part of Mount Pelion; and hence the appellation *throna*, signifying "flowers." Lucan says the Centaurs were natives of that place; to whom Virgil assigns Mount Othrys. Most authors, however, ascribe the breaking of horses to the Centaurs. Some make the Lapithæ and Centaurs the same; others a different people; allowed however to be both of Thessaly. Their story is greatly involved in fable. See LAPITHUS.

PELEUS, in *Fabulous History*, a king of Thessaly, son of Æacus and Endeis, the daughter of Chiron. He married Thetis one of the Nereids, and was the only mortal man who ever married an immortal. He was concerned in the murder of his brother Phocus, and was therefore obliged to leave his father's dominions. He fled to the court of Eurytus the son of Actor, who reigned at Phthia, or according to the opinion of Ovid, the truth of which is questioned, to Ceyx king of Trachinia. He was purified of his murder by Eurytus, with the usual ceremonies, and the king gave him his daughter Antigone in marriage. After this, as Peleus and Eurytus went to the chase of the Calydonian boar, the father-in-law was accidentally killed by an arrow which his son-in-law had aimed at the beast. This unfortunate action obliged him to banish himself from the court of Phthia, and he went to Iolchos, where he was also purified of the murder of Eurytus by Acastus the king of the country. His residence at Iolchos was short: Astydamia the wife of Acastus fell in love with him; but when she found him insensible to her passionate declarations, she accused him of attempts upon her virtue. The king her husband partly believed the accusations of his wife; but not willing to violate the laws of hospitality, by putting him instantly to death, he ordered his officers to conduct him to Mount Pelion, on pretence of hunting, and there to tie him to a tree and to leave him a prey to the wild beasts of the place. The orders of Acastus were faithfully obeyed: but Jupiter knowing the innocence of his grandson Peleus, ordered Vulcan to set him at liberty. As soon as he had been delivered from danger, Peleus assembled his friends in order to punish the ill treatment which he had received from Acastus. He took Iolchos by force, drove the king from his possessions, and put to death the wicked Astydamia. On the death of Antigone, Peleus made love to Thetis, of whose superior charms Jupiter himself had been enamoured. His pretensions were rejected; for as he was but a mortal, the goddess fled from him with the uttmost abhorrence, and the more effectually to evade his inquiries, she generally assumed the shape of a bird, or a tree, or of a tygress. Peleus's passion was fanned by refusal: he offered a sacrifice to the gods; and Proteus informed him, that to obtain Thetis he must surprise her while she was asleep in her grotto, near the shores of Thessaly. This advice was immediately attended to; and Thetis, unable to escape from the grasp of Peleus, at last consented to marry him. Their nuptials were celebrated with the greatest solemnity, all the gods attending and making them each the most valuable presents. The goddess of Discord was the only one of the deities who was absent; and she punished this seeming neglect by throwing an apple in the midst of the assembly of the gods, with the inscription of *Detur pulchriori.* The celebrated Achilles was the fruit of this marriage, whose education was early entrusted to the Centaur Chiron, and afterwards to Phœnix, the son of Amyntor. Achilles, it is well known, went to the Trojan war, at the head of his father's troops; and Peleus gloried in having a son who was superior to all the Greeks in valour and intrepidity. His death, however, was the source of great grief to Peleus; but Thetis, to comfort her husband, promised him immortality, and ordered him to retire into the grottoes of the island of Leuce, where he should see and converse with the manes of his son. Peleus had a daughter called *Polydora*, by Antigone.

PELEW ISLANDS, a clustre of small islands situated between the latitudes of 5° and 7° north, and the longitudes 134° and 136° east. Various conjectures have been formed respecting the time of their first discovery by Europeans. Mr Keate, the editor of the only voyage in which we have any account of their climate, soil, and produce, together with the manners of their inhabitants, thinks they were first noticed by the Spaniards from the Philippines, and by them named *Palos* from the number of trees growing in them resembling the masts of ships. This conjecture has been vehemently opposed by a critic, who affirms that the whole of Mr Keate's introduction is erroneous, and that the islands in question were first discovered by a French Jesuit named *Pere Papin.* The Jesuit, he imagines, was directed to them by one of the inhabitants, who had found his way to the Moluccas, where he was baptized. They are said to have been again noticed by *P. Centova* in 1724, who, saw at Agdane, the capital of the Merian islands, some of the inhabitants; and from their account gives a description not very favourable of these harmless islanders. Centova's description is to be found in the 15th volume, and the relation of the discovery by P. Papin in the 11th volume, of *Lettres Edifiantes et Curieuses*, published at Paris 1781.

The latest and most authentic account of them, however is given from the Journals of Captain Wilson of the Antelope, a packet belonging to the East India company, which was wrecked upon one of them in August 1783. This ship was fitted out in England by the court of directors in the summer 1782, as was then generally understood, for a secret expedition. Whatever may have been her destination, as she was proceeding from Macao in squally weather, the man, who, on the night of the 10th of August, had the look-out, suddenly called out *Breakers!* But the sound of the word had scarce reached the ears of the officer on deck, before the ship struck and stuck fast; and in less than an hour bulged and filled with water. Having secured the gunpowder, small arms, bread, and such other provisions as were liable to be spoiled with water, Captain Wison, after many difficulties, effected a landing. The crew of the Antelope consisted of 33 Europeans besides the captain, and 16 Chinese: and the only possible means by which they could be delivered from an island, which at first appeared to them uninhabited, was by building a ship capable of transporting them to the nearest Euro-

Pelew Islands.

pean settlement in that quarter of the globe. Whilst they were meditating upon this undertaking, the natives appeared on the second day after their arrival; and their intercourse with them was facilitated by means which appear as singular as they were providential. Captain Wilson had a servant recommended to him at Macao, who spoke both the Malay and English languages perfectly well; and they had not been long at Pelew before they had the good fortune to meet with a Malay, who had been thrown by a tempest upon this very spot about a year before, and had made himself acquainted with the language of the country; so that by this extraordinary event each party had an interpreter who could readily explain their wants and desires, and by that means prevent a number of misconceptions which might have arisen from making use of signs and gestures only.

The natives are all of a deep copper colour, going perfectly naked. They are of a middling stature, very straight, muscular, and well formed; but their legs, from a little above their ancles to the middle of their thighs, are tatooed so very thick, as to appear dyed of a far deeper colour than the rest of their skin. Their hair is of a fine black, long, and rolled up behind, in a simple manner, close to the back of their heads, which appeared both neat and becoming; but few of them had beards, it being the general custom to pluck them out by the roots.

They began by stroking the bodies and arms of the English, or rather their waistcoats and coat sleeves, as if they doubted whether the garment and the man were not of the same substance; and as the Malay explained the circumstances to them, our people were greatly surprised at the quickness with which they seemed to comprehend every information he gave them. The next thing they noticed was our people's white hands, and the blue veins of their wrists; the former of which they seemed to consider as artificial, and the other as the English manner of tatooing. After being satisfied in this particular, they expressed a further wish to see their bodies; and, among other things, were greatly surprised at finding hair on their breasts, it being considered by them as a great mark of indelicacy, as it is their custom to eradicate it from every part of the body in both sexes.

They afterwards walked about, testifying great curiosity at every thing they saw, but at the same time expressing a fear that they might be thought too intruding. As our people were conducting them to the tents, one of the natives picked up a bullet, which had been casually dropped on the ground, and immediately expressed his surprise, that a substance so small to the eye should be so very ponderous to the touch; and on their entering the tent, a large Newfoundland dog, and a spaniel, which had been tied up there to prevent their being lost, set up a most violent barking, and the natives a noise but little less loud, which at first it was not easy to account for. They ran in and out of the tent, and seemed to wish that they might be made to bark again. This the Malay soon explained to be the effect of their joy and surprise, as these were the first large animals they had ever seen, there being no quadrupeds of any species on these islands, except a very few grey rats in the woods.

After some time it was agreed on by Captain Wilson and his people, that some of the crew should be sent to the king of the place, in order to solicit his friendship, and intreat his permission to build a vessel that might carry them back to their own country. This business was allotted to the captain's brother; and during hi absence, Raa Kook, the king's brother, and several o the natives, remained with our people. This amiable chief seemed to place an entire confidence in those h was among; he endeavoured to accommodate himself t their manners; would sit at table as they did, instead of squatting on his hams; and inquired particularly int the principles and causes of every thing he observed about him, lending his personal assistance in all that wa going forward, and even desiring the cook to let hin aid him in blowing the fire.

In order to conciliate their affections, Captain Wilso had presented Arra Kooker, another of the king's brothers, with a pair of trowsers; but having conceived greater passion for a white shirt, one was immediatel given to him; which he had no sooner put on, than h began to dance and jump about with so much joy, tha every body was diverted by his singular gestures, an the contrast which the linen formed with his skin. Thi prince was about 40, of a short stature, but so plum and fat that he was nearly as broad as he was long. H possessed an abundant share of good humour, and a wonderful turn for mimickry; and had besides a countenance so lively and expressive, that though our peopl at this time were strangers to almost all he said, yet hi face and gestures made them accurately comprehen whatever he was describing.

After three or four days, Abba Thulle the king arrived with a great retinue. He was received with ever mark of respect by the ship's company, who were exercised before him, and fired three volleys in differen positions. The surprise of the natives, their hooting, hallooing, jumping, and chattering, produced a noise almost equal to the discharge of the muskets; and whe one of the men shot a bird, which was done to display the effect of their arms, the surprise it occasioned wa wonderful. Some of the natives ran for it, and carrie it to the king, who examined it with great attention, bu was unable to comprehend how it could be wounded not having seen any thing pass out of the gun.

Raa Kook expressed great impatience to show the kin whatever had impressed his own mind; and taking hi brother by the hand, led him to a grindstone which wa fixed behind one of the tents. He immediately put i in motion as he had frequently done before; at the rapidity of which the king was greatly astonished, particularly when he was informed that it would sharpe iron. Captain Wilson ordered a hatchet to be brough and ground, that they might more readily perceive it operation, when Raa Kook eagerly seized the handl and began turning it, appearing highly delighted to le his brother see how well he understood it. The whol appeared like something supernatural; but the circumstance which most bewildered their ideas was, how th sparks of fire could come, and how a stone so well wetted could become so soon dry.

The king then visited the different tents, and inquire about every thing he saw: all was novelty, and of cours interested his attention. When he got to the tent wher the Chinese men were, who had been brought with the from Macao, Raa Kook, whose retentive mind neve

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lost a single trace of any thing he had been informed of, acquainted the king that these were a people quite different from the English, and that he had learnt there were many other nations besides these interspersed through the world, some of which fought with guns and others with boarding-pikes, an instrument which he held very cheap in comparison with the former.

When the king heard his brother discoursing about a variety of nations, who all spoke differently, and had before him the example of the Chinese, whose language was not the same with the English, he appeared instantly thoughtful and serious, as if struck by conceptions which had never before crossed his mind. He remained a while pensive and bewildered; and this circumstance impressed on every one at the time an idea that there was every reason to imagine that there had never been a communication between those people and any other nation: and indeed it is evident, that if Pere Papin did really visit them in 1710, they had before 1783 lost the remembrance of every trace of European manners. This indeed is not surprising, as they had no other record than knots similar to the quipes of Peru at the landing of the Spaniards.

Raa Kook would now show his brother the kitchen, which was in the hollow of a rock, a little above the cove. It was at the time when the cook was preparing dinner; and though the implements were exceedingly scanty, an iron pot, a tea kettle, a tin sauce-pan, with a poker, a pair of tongs, and a frying-pan, were here of sufficient consequence to excite admiration; nor were the bellows now forgotten by Raa Kook, who taking them up, as he explained their use to the king, seemed ambitious to let his brother see what an adept he was at blowing. The little bald cook, who was always close shaven, and never wore any thing on his head, was likewise pointed out to the king as an object of merriment and curiosity.

Some time after this the king requested five of Captain Wilson's men to attend him in a war he was going to make against the inhabitants of a neighbouring island called *Oroolong*, who, as he said, had done him an injury. But before this request was made known, he had long struggled with a delicacy of sentiment which no one would have expected to find in regions so disjoined from the rest of mankind. This was no other than that it might prove a temporary inconvenience to the unfortunate strangers who had sought his protection, and might be considered by them as an ungenerous proceeding. It was, however, no sooner made known, than Captain Wilson instantly complied; and every face, which had before been clouded with doubt and apprehension, became immediately brightened and gay.

In this enterprise little more was done than braving their enemies, stripping some cocoa-nut trees of their fruit, and carrying off a number of yams and other provisions; but in another, which was undertaken against the island of Artingall, they were more successful, and showed signs of the same sanguinary disposition which some demon has infused into the whole human race. Nine prisoners of war who had been taken upon this occasion were cruelly put to death; and notwithstanding the English strongly remonstrated against this proceeding, all the arguments they could use were of no avail. In justification of their conduct, they alleged the necessity of doing it for their own security, declaring that they had formerly only detained them as menial servants, but that they always found means to get back to their own country, and return with such a force as frequently made great depredations.

Having given this general account of the character and conduct of these hitherto unknown people, we now proceed to lay before our readers what we have learned of their government, customs, manners, and arts, together with a description of the face of their country. In this the editor of Captain Wilson's voyage must be our guide; and if our narrative do not satisfy the man of science, it is to be observed, that the Antelope was not a ship sent out purposely to explore undiscovered regions, nor were there people on board properly qualified to estimate the manners of a new race of men; they had amongst them no philosophers, botanists, or draughtsmen, experienced in such scientific pursuits as might enable them to examine with judgment every object which presented itself. Distress threw them upon these islands; and while they were there, all their thoughts were occupied on the means of liberating themselves from a situation of all others the most afflicting to the mind, that of being cut off for ever from the society of the rest of the world.

It, however, clearly appears, from their uniform testimony, that at Pelew the king was considered as the first person in the government.

"He was looked up to as the father of his people; and though divested of all external decorations of royalty, had every mark of distinction paid to his person. His *rupacks* or chiefs approached him with the greatest respect; and his common subjects whenever they passed near him, or had occasion to address him, put their hands behind them, and crouched towards the ground. Upon all occurrences of moment, he convened the rupacks and officers of state; their councils were always held in the open air, where the king first stated the business upon which he had assembled them, and submitted it to their consideration. Each rupack delivered his opinion, but without rising from his seat; and when the matter before them was settled, the king standing up put an end to the council.

"When any message was brought him, whether in council or elsewhere, if it came by one of the common people, it was delivered at some distance in a low voice to one of the inferior rupacks, who, bending in a humble manner at the king's side, delivered it in the same manner with his face turned aside. His commands appeared to be absolute, though he acted in no important business without the advice of his chiefs; and every day in the afternoon, whether he was at Pelew or with the English, he went to sit in public for the purpose of hearing any requests, or of adjusting any difference or dispute which might have arisen among his subjects."

But these, according to our editor, seldom happened; for as their real wants were but few, and they saw nothing to create artificial ones; every one was chiefly occupied with his own humble pursuits; and as far as the ship's crew, who remained among them about three months, could decide, they appeared to conduct themselves towards each other with the greatest civility and benevolence; never wrangling or entering into quarrelsome contentions, as is customary among those who call themselves a polished and enlightened people. Even when children showed a disposition of this kind, they strongly marked their displeasure, by stifling with rebuke their little animosities.

The character of the king is thus drawn by the editor: "The excellent man who reigned over these sons of nature, showed himself in every part of his conduct firm, noble, generous, and benevolent; there was a dignity in all his deportment, a gentleness in all his manners, and a warmth and sensibility about his heart, that won the love of all who approached him. Nature had bestowed on him a contemplative mind, which he had improved by those reflections that good sense dictated and observation confirmed. The happiness of his people seemed to be always in his thoughts. In order more effectually to stimulate them to useful labour, he had himself learnt all the few arts they possessed, and was looked on in some of them to be the best workman in his dominions. Placed as he was by Providence in its obscurer scenes, he lived beloved by his chiefs, and revered by his people; over whom, whilst he preserved a dignity which distinguished his superior station, he reigned more as the father than the sovereign. The eyes of his subjects beheld their naked prince with as much awe and respect as those are viewed with who govern polished nations, and are decorated with all the dazzling parade and ornaments of royalty; nor was the purple robe or the splendid diadem necessary to point out a character which the masterly hand of nature had rendered so perfect.

Next in power to the king was his brother Raa Kook, who was official general of all his forces. It was his duty to summon the rupacks to attend the king for whatever purpose they were wanted. He was also his presumptive heir; the succession of Pelew not going to the king's children till it had passed through his brothers; so that after the demise of Abba Thulle, the sovereignty would have descended to Raa Kook; on his demise to Arra Kooker; and on the death of this last it would have reverted to Qui Bill, the king's eldest son, when Lee Boo, his second son, of whom we have much to say, would have become the hereditary general.

The office of first minister is described as follows: "The king was always attended by a particular chief or rupack, who did not appear to possess any hereditary office, but only a delegated authority. He was always near the king's person, and the chief who was always first consulted; but whether his office was religious or civil, or both, our people could not learn with any certainty. He was not considered as a warrior, or ever bore arms, and had only one wife, whereas the other rupacks had two. The English were never invited to his house, or introduced into it, although they were conducted to those of almost every other chief."

Of the rupacks it is observed, "That they could only be regarded as chiefs or nobles; they were not all of the same degree, as was plain by a difference in the *bone* (A) they wore: they generally attended the king, and were always ready at his command to accompany him on any expedition with a number of canoes properly manned, and armed with darts and spears, who were to remain with him till they had his permission to return home with their dependents. In this part of their government we may trace an outline of the feudal system; but from the few opportunities our people had of investigating points of internal government, it appeared that the titles of *rupacks* were personal badges of rank and distinction; nor did they apprehend they were hereditary honours, unless in the reigning family, who must of necessity be of this class."

As to property, it was understood, "That the people possessed only such as arose from their own work and labour, but no absolute one in the soil, of which the king appeared to be general proprietor. A man's house, furniture, or canoe, was considered as his private property, as was also the land allotted him, as long as he occupied and cultivated it; but whenever he removed with his family to another place, the ground he held reverted to the king, who gave it to whom he pleased, or to those who solicited to cultivate it."

All that part of the island which they had an opportunity of seeing is said to have been well cultivated. It wa covered with trees of various kinds and sizes, many o which must have been very large, as they made canoe of their trunks, some of which were capable of carryin twenty-eight or thirty men. Among the timber tree was noticed the ebony, and a tree which when pierced o wounded, yielded a thick white liquor of the consistenc of cream. "They had also a species of the manchine tree, in cutting down of which our people frequentl got blistered and swelled; the inhabitants pointed ou the cause, saying it was owing to their being sprinkle by the sap. This they reckoned among the unluck trees, and advised our people against the use of it."

But the most singular tree noticed at Pelew, wa one in its size and manner of branching not unlike o cherry tree, but in its leaves resembling the myrtl Its peculiarity was, that it had no bark, but only outward coat of about the thickness of a card, whi was darker than the inside, though equally close in te ture. Its colour was nearly that of mahogany, and t wood was so extremely hard, that few of the tools whi the English had could work it. They also found ca bage-trees, the wild bread-fruit, and another tree, wh fruit something resembled an almond. But yams a cocoa-nuts, being their principal articles of sustenan claimed their chief attention.

The island Coorooraa, of which Pelew is the capi likewise produced plantains, bananas, Seville orang and lemons, but neither of them in any considera quantity. None of the islands which the English visi had any kind of grain. As to birds, they had ple of common cocks and hens, which, though not dome cated, kept running about near their houses and pl tations; and what appears extremely singular is, that natives had never made any use of them, till our pe told them they were excellent eating. Pigeons t accounted a great dainty; but none but those of a tain dignity were permitted to eat of them. The E glish left them two geese, which were the only rem of their live stock.

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(A) This was a mark of rank worn upon the wrist, with which Captain Wilson was invested by the king ; what animal it came from our people could not learn.

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From the description of the country it appears to be very mountainous; but some of the valleys are represented as extensive and beautiful, affording many delightful prospects. The soil being very rich produces great abundance of grass, which, as there are no cattle to eat it, grows very high, and was scorched and burnt up by the sun. Our people saw no river at Pelew; their supplies of fresh water being obtained from small streams and ponds, of which there are a great many.

From this account of the scanty produce of these islands, it is evident that no luxury reigned among their inhabitants, whose principal article of food appears to be fish; they had no salt, nor did they make use of sauce or any seasoning in any thing they ate. Their drink was also as simple as their diet: it principally consisted of the milk of the cocoa nut; but upon particular occasions they used a kind of sweet drink and sherbet, which latter had the addition of some juice of orange.

The islands appeared to be populous, though to what extent could not be ascertained. Their houses were raised about three feet from the ground, upon stones which appeared as if hewn from the quarry. The interior part of them was without any division, the whole forming one great room, which rose in a ridge like our barns, the outside being thatched thick and close with bamboos or palm leaves. All their implements, utensils, weapons of war, and canoes, are much of the same kind with those which were found in the South sea islands.

In their marriages they allow a plurality of wives, thought not in general more than two. When a woman is pregnant, the utmost attention is paid to her; but upon other occasions no more respect is shown to one sex than the other. "One of our people endeavouring to make himself agreeable to a lady belonging to one of the rupacks, by what we should call a marked assiduity, Arra Kooker, with the greatest civility, gave him to understand that it was not right to do so."

They have places particularly appropriated to sepulture; their graves being made nearly the same as they are in our country churchyards. The corpse is attended only by women, who at the place of interment make a great lamentation. The men, however, assemble round the body before it is carried to the grave, on which occasion they preserve a solemn silence; "their minds, from principles of fortitude or philosophy, being armed to meet the events of mortality with manly submission, divested of the external testimony of human weakness."

On the article of religion our editor observes, "That among all the race of men whom navigation has brought to our knowledge, few appear to be without a sense of something like religion, however it may be mixed with idolatry or superstition. And yet our people, during their continuance with the natives of Pelew, never saw any particular ceremonies, or observed any thing that had the appearance of public worship. But though there was not found on any of the islands they visited any place appropriated to religious rites, it would perhaps be going too far to declare that the people of Pelew had absolutely no idea of religion. Independent of external testimony, there may be such a thing as the religion of the heart, by which the mind may in awful silence be turned to contemplate the God of Nature; and though unblessed by those lights which have pointed to the Christian world an unerring path to happiness and peace, yet they might, by the light of reason only, have discovered the efficacy of virtue, and the temporal advantages arising from moral rectitude.

"Superstition is a word of great latitude, and vaguely defined: though it hath in enlightened ages been called the offspring of ignorance, yet in no time hath it existed without having some connection with religion. Now the people of Pelew had beyond all doubt some portion of it, as appeared by the wish expressed by the king when he saw the ship building, that the English would take out of it some particular wood, which he perceived they had made use of, and which he observed was deemed an ill omen, or unpropitious.

"They had also an idea of an evil spirit, that often counteracted human affairs. A very particular instance of this was seen when Mr Barker, a most valuable member in the English society, fell backwards from the side of the vessel, whilst he was on the stocks: Raa Kook, who happened to be present, observed that it was owing to the unlucky wood our people had suffered to remain in the vessel, that the evil spirit had occasioned this mischief to Mr Barker."

They likewise appeared to entertain a strong idea of divination, as was evident from the ceremonies they practised before they undertook any enterprise of moment. A few occurrences, which are mentioned in the course of the narrative, would also lead us to believe that they could not be altogether unacquainted with the nature of religious worship; for when they were present at the public prayers of the English, they expressed no surprise at what was doing, but seemed desirous to join in them, and constantly preserved the most profound silence. The general even refused to receive a message from the king which arrived during divine service. And upon another occasion, when Captain Wilson told Lee Boo, that good men would live again above, he replied, with great earnestness, "All same Pelew; bad men stay in earth; good men go into sky; become very beautiful;" holding his hand up, and giving a fluttering motion to his fingers. Some later voyagers, however, have affirmed, that these people, notwithstanding their superstition, have no notion whatever of a Deity; a circumstance to which it is extremely difficult to give full credit.

The most wonderful circumstances in the history of this people, except that last mentioned, are the acuteness of their understanding, their hospitality, and the implicit confidence which they placed in utter strangers. That their manners were pleasing, and their society not disagreeable, is evident from the conduct of Madan Blanchard, one of the seamen, who, when the vessel was built and ready to take her departure with his captain and his companions, was left behind at his own particular request. That they had the fullest confidence in Captain Wilson and his crew, is put beyond a doubt by the behaviour of the king and Raa Kook when their guests were to leave them. Raa Kook solicited his brother's permission to accompany the English, but from prudential motives was refused. The sovereign, however, resolved to entrust his second son Lee Boo to Captain Wilson's care, that he might improve his mind, and learn such things as at his return would benefit his country.

The instructions which he gave the young man, and the fortitude which he showed upon this occasion, would

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would have done honour to the most enlightened mind. Upon delivering him to Captain Wilson, he used these expressions: "I would wish you to inform Lee Boo of all things which he ought to know, and make him an Englishman. The subject of parting with my son I have frequently revolved; I am well aware that the distant countries he must go through, differing much from his own, may expose him to dangers, as well as diseases, that are unknown to us here, in consequence of which he may die; I have prepared my thoughts to this: I know that death is to all men inevitable; and whether my son meets this event at Pelew or elsewhere is immaterial. I am satisfied, from what I have observed of the humanity of your character, that if he is sick you will be kind to him; and should that happen, which your utmost care cannot prevent, let it not hinder you, or your brother, or your son, or any of your countryman, returning here; I shall receive you, or any of your people, in friendship, and rejoice to see you again." How noble! This is the language of a king, a father, and a philosopher, who would have been delighted to see his son with European accomplishments. But, alas! the subsequent history of this amiable youth must force a tear from the eye of every reader whose heart is not callous to the genuine feelings of nature and humanity. As soon as they arrived at Macao, the house into which he first entered, and the different articles of furniture, fixed him in silent admiration; but what struck his imagination most was the upright walls and flat ceilings of the rooms, being utterly unable to comprehend how they could be so formed. When he was introduced to the ladies of the family, his deportment was so easy and polite, that it could be exceeded by nothing but his abundant good nature; and at his departure, his behaviour left on the mind of every one present the impression, that, however great the surprise might be which the scenes of a new world had awakened in him, it could hardly be exceeded by that which his own amiable manners and native polish would excite in others.

They were now conducted to the house of an English gentleman, who introduced them into a large hall, which was lighted up, with a table in the middle, covered for supper, and a sideboard handsomely decorated. Here a new scene burst at once upon Lee Boo's mind; he was all eye, all admiration. The vessels of glass particularly rivetted his attention; but when he surveyed himself in a large pier glass at the upper end of the hall, he was in raptures with the deception. It was in truth, to him, a scene of magic, a fairy tale

Soon after the people of the vessel came on shore, some of them went to purchase things they were in want of; in doing which they did not forget Lee Boo, who was a favourite with them all. Among the trinkets they brought him was a string of large glass beads, the first sight of which almost threw him into an ecstacy: he hugged them with a transport which could not have been exceeded by the interested possessor of a string of oriental pearls. His imagination suggested to him that he held in his hand all the wealth the world could afford him. He ran with eagerness to Captain Wilson to show him his riches, and begged he would get him a Chinese vessel to carry them to the king his father, that he might see what the English had done for him; adding, that if the people faithfully executed their charge, he would at their return present them with
or two beads as a reward for their services.

Having no quadrupeds at Pelew, the sheep, go
and other cattle, which he met with at Macao, w
viewed with wonder; but soon after, seeing a man
the house on horseback, he was so much astonis
that he wanted every one to go and look at the stra
sight. After the matter, however, was explained
him, he was easily persuaded to get upon horseb
himself; and when he was informed what a noble,
cile, and useful animal it was, he besought the capt
to send one to his uncle Raa Kook, as he was sur
would be of great service to him.

Omitting a number of other particulars of this k
which excited his curiosity and showed the excel
disposition of his heart, we shall follow him to E
land, the country from which he was never to ret
Here he had not been long before he was sent to an
demy to be instructed in reading and writing, whic
was extremly eager to attain, and most assiduou
learning. His temper was mild and compassionat
the highest degree; but it was at all times governe
discretion and judgment. If he saw the young ask
relief, he would rebuke them with what little Eng
he had, telling them it was a shame to beg when
were able to work; but the entreaties of old age
could never withstand, saying, "Must give poor
man, old man no able to work."

He always addressed Mr Wilson by the nam
Captain, but never would call Mrs Wilson by any o
name than mother, looking on that as a mark of
greatest respect; and such was the gratitude of his h
for the kindness they showed him, that if any of the
mily were ill, he always appeared unhappy, would c
softly up to the chamber, and sit silent by the bed
for a long time together without moving, peeping g
ly from time to time between the curtains, to see if
slept or lay still.

He was now proceeding with hasty strides in gai
the English language, writing, and accounts, whe
was overtaken by that fatal disease, the smallpox, w
the greatest pains had been taken to guard him agai
and notwithstanding the utmost care and attentio
his physician, he fell a victim to this scourge of the
man race.

Upon this trying occasion, his spirit was above c
plaining, his thoughts being all engrossed by the k
ness of his benefactors and friends. He told his
tendant, that his father and mother would grieve
much, for they knew he was sick. This he repe
several times, "and begged him to go to Pelew,
tell Abba Thulle that Lee Boo take much drin
make smallpox go away, but he die; that the cap
and mother very kind; all English very good m
much sorry he could not speak to the king the nun
of fine things the English had got." Then he reck
up the presents which had been given him, desiring
they might be properly distributed among the ch
and requesting that particular care might be take
two glass pedestals, which he begged might be pres
ed to his father.

We have given this short history of Lee Boo, bec
it exhibits in a strong light the manners of the nat
of the Pelew islands, to which we know nothing sin
in the history of man from the savage state to tha
civilizat

civilization. They appear to have had no communication with any other people, and were yet neither treacherous, cruel, nor cowardly. They are a striking instance of the weakness of all the philosophic theories by which mankind are usually traced from their origin through the several stages of savagism, barbarism, and civilization, down to the period of refinement, ending in effeminacy.

Since the publication of Captain Wilson's voyage we have some further accounts of these islands, all confirming what we were first told of the gentleness of the people. Two armed ships were, by order of the court of directors, fitted out at Bombay, for the purpose of surveying the islands of Pelew, and furnishing the natives with domestic animals, and such other things as might add to the comforts of life. Among the presents to the king were swords and other European implements of war; of which it is at least possible that he and his people might have been equally happy had they remained for ever in total ignorance. The foundation of a fort was likewise laid on one of the islands, and possession of it taken in the name of the English; we trust with no remote view of enslaving the people, or of driving them from their native country. It has been likewise announced in a late publication, that Captain M'Cluer, who commanded the armed ships, was so delighted with the manners of the king and his subjects, that he was resolved to pass the remainder of his days on those islands at the early age of 34. The following is the sequel of the adventure here alluded to. The two vessels called the Panther and Endeavour, under the command of Captain M'Cluer, were fitted out for a voyage to the Pelew islands, to acquaint Abba Thulle the king with the death of his favourite son Lee Boo, who went to England with Captain Wilson in the Antelope in 1783, where he died. On the 24th of August 1790 Captain M'Cluer sailed from Bombay, having on board Messrs White and Wedgeborough, who had been shipwrecked with Captain Wilson, and were much esteemed by the king of those islands, at which he arrived in January 1791. Abba Thulle, the king, received them with demonstrations of joy as Englishmen, of whom he had previously found reason to entertain a very favourable opinion. The presents which the company sent to Abba Thulle were landed with all convenient speed. These consisted of a considerable quantity of live stock, such as cows, bulls, ewes, rams, goats, pigs, and poultry, together with arms, ammunition, and packages of hardware, comprising a number of articles which could not fail to be of singular advantage to the natives. The grateful king was astonished at the meaning of all this, and being informed that it was a small acknowledgement for his generous treatment of the crew of the Antelope, when wrecked on his coast, he expressed his regret that it was not in his power to have done more.

With the nature and situation of these islands, as well as the amiable and engaging manners of the natives, Captain M'Cluer was so well pleased, that he considered them as a paradise, where he could spend with pleasure the remainder of his days. Soon after these transactions the Panther sailed in the month of February from the Pelew islands for China, the Endeavour remaining behind till her return, which happened on the 10th of June the same year. Having visited these islands a third time, after a survey of the coast of New Guinea, he signified to the officers of the Panther his intention of resigning the command of the expedition, and remaining on the islands. To render his new situation as comfortable as possible, he requested from Mr Wedgeborough about 20 muskets with bayonets, 12 pistols, 12 pole-axes, 2 wall-pieces, fusee and pistol ammunition, an anvil, bellows, frame-saw, standing vice, &c. After a consultation with the other officers, it was agreed on to send him these articles, on condition that they should be accounted for by his attorneys, if the East India Company should not be satisfied with the measure. This resolution was carried into effect in the month of February 1793.

Scarcely, however, had he been 15 months in his new settlement till he became impatient to abandon it, and he soon after set sail for Macao. He returned to the Pelew islands in the year 1795, for the purpose of removing his family; and sailing from thence to Bombay, he touched at Bencoolen, where he met with a frigate bound for Bombay, into which he put a part of his family with six Pelew women, sailing himself with the other natives towards Bengal, from which last place he set sail some time after; but neither he nor any of his crew have been since heard of.

PELIAS, in fabulous history, twin-brother of Neleus, was son of Neptune by Tyro, daughter of Salmoneus. His birth was concealed by his mother, who wished her father to be ignorant of her incontinence. He was exposed in the woods, but his life was preserved by shepherds; and he received the name of *Pelias*, from a spot of the colour of *lead* in his face. Some time after Tyro married Cretheus, son of Æolus, king of Iolchos, and became mother of three children, of whom Æson was the eldest. Pelias visited his mother, and was received in her family; and after the death of Cretheus, he unjustly seized the kingdom, which belonged not to him, but to the children of Tyro by the deceased king. To strengthen himself in his usurpation, Pelias consulted the oracle; and when he was told to beware of one of the descendants of Æolus, who should come to his court with the one foot shod and the other bare, he privately removed the son of Æson, after he had openly declared that he was dead. These precautions proved vain. Jason, the son of Æson, who had been educated by Chiron, returned to Iolchos, when come to years of maturity; and having lost one of his shoes in crossing the river Anaurus or the Evenus, Pelias immediately perceived that this was the person whom he had so much dreaded. His unpopularity prevented him from acting with violence to a stranger, whose uncommon dress and commanding aspect had raised admiration in the people. But his astonishment was greatly excited, when he saw Jason arrive at his palace, with his friends and relations, and boldly demand the kingdom which he had usurped. Pelias, conscious that his complaints were well founded, endeavoured to divert his attention, and told him that he would voluntarily resign the crown to him, if he went to Colchis to avenge the death of Phryxus, the son of Athamas, whom Æeres had cruelly murdered. He further declared, that the expedition would be attended with the greatest glory, and that nothing but the infirmities of old age had prevented himself from vindicating the honour of his country, and the injuries of his family, by punishing the assassin. This so warmly ly recommended, was with equal warmth accepted by the young hero, and his intended expedition was made known all over Greece. While Jason was absent in the Argonautic expedition, Pelias murdered Æson and all his family; but, according to the more received opinion of Ovid, Æson was still living when the Argonauts returned, and he was restored to the flower of youth by the magic of Medea. This change in the vigour and the constitution of Æson astonished all the inhabitants of Iolchos; and the daughters of Pelias, who have received the patronymic of Peliades, expressed their desire to see their father's infirmities vanish by the same powerful magic. Medea, who wished to avenge the injuries which her husband Jason had received from Pelias, raised the desires of the Peliades, by cutting an old ram to pieces, and boiling the flesh in a cauldron, and then turning it into a fine young lamb. After they had seen this successful experiment, the Peliades cut their father's body to pieces, after they had drawn all the blood from his veins, on the assurance that Medea would replenish them by her wonderful power. The limbs were immediately put into a cauldron of boiling water; but Medea suffered the flesh to be totally consumed, and refused to give the promised assistance, and the bones of Pelias did not even receive a burial. The Peliades were four in number, Alceste, Pisidice, Pelopea, and Hippothoe, to whom Hyginus adds Medusa. Their mother's name was Anaxibia, the daughter of Bias or Philomache, the daughter of Amphion. After this parricide, the Peliades fled to the court of Admetus, where Acastus, the son-in-law of Pelias, pursued them, and took their protector prisoner. The Peliades died, and were buried in Arcadia.

PELICAN, a genus of birds belonging to the order of anseres. See ORNITHOLOGY *Index*.

PELICAN, in *Chemistry*, is a glass alembic consisting of one piece, with a tubulated capital, from which two opposite and crooked beaks pass out, and enter again at the bottom of the cucurbit. This vessel was contrived by the older chemists for a continued distillation, but has gone into disuse.

PELICANUS, a genus of birds belonging to the order of anseres. See ORNITHOLOGY *Index*.

PELION (Diodorus Siculus, &c.), *Pelios, mons* understood, (Mela, Virgil, Horace, Seneca), a mountain of Thessaly near Ossa, and hanging over the Sinus Pelasgicus, or Pegasicus; its top covered with pines, the sides with oaks, (Ovid). Said also to abound in wild ash (Val. Flaccus). From this mountain was cut the spear of Achilles, called *pelias*, which none but himself could wield, (Homer). Dicearchus, Aristotle's scholar, found this mountain 1250 paces higher than any other of Thessaly, (Pliny). *Pelius*, Cicero; *Peliacus*, (Catullus), the epithet.

PELLA, in *Ancient Geography*, a town situated on the confines of Emathia, a district of Macedonia, (Ptolemy); and therefore Herodotus allots it to Bottiæa, a maritime district on the Sinus Thermaïcus. It was the royal residence, situated on an eminence, verging to the south-west, encompassed with unpassable marshes summer and winter: in which, next the town, a citadel like an island rises, placed on a bank or dam, a prodigious work, both supporting the wall and securing it from any hurt by means of the circumfluent water. At a distance, it seems close to the town, but is separated from it by the Ludias, running by the walls, and joined to it by a bridge, (Livy): distant from the sea 120 stadia, the Ludias being so far navigable, (Strabo). Mela calls the town *Pelle*, though most Greek authors write *Pella*. The birth-place of Philip, who enlarged it; and afterwards of Alexander, (Strabo, Mela). Continued to be the royal residence down to Perses, (Livy). Called *Pella Colonia*, (Pliny); *Colonia Julia Augusta*, (Coin). It afterwards came to decline, with but few and mean inhabitants, (Lucian). It is now called *Τα Παλατιτσα*, the *Little Palace*, (Holstenius). *Pellæus*, both the gentilitious name and the epithet, (Lucian, Juvenal, Martial.)—Another PELLA, (Polybius, Pliny); a town of the Decapolis, on the other side the Jordan; abounding in water, like its cognominal town in Macedonia; built by the Macedonians, (Strabo); by Seleucus, (Eusebius); anciently called *Butis*, (Stephanus); *Apamea*, (Strabo); situated 35 miles to the north-east of Gerasa, (Ptolemy). Thither the Christians, just before the siege of Jerusalem by Titus, were divinely admonished to fly, (Eusebius). It was the utmost boundary of the Peræa, or Transjordan country, to the north, (Josephus).

PELLETIER, BERTRAND, a celebrated chemical philosopher, was born at Bayonne in 1761, and very soon discovered a strong predilection for the sciences, to cherish which he had every thing in his father's house that could be reasonably desired, and here he acquired the elements of that art for which he was afterwards so famous. His subsequent progress he made under Darcet, who admitted him among the pupils attached to the chemical laboratory of France. Five years intense application under such a master, gave him a stock of knowledge very uncommon at his years. As a convincing proof of this, he published, when only 21, a number of valuable observations on arsenic acid, proving, contrary to the opinion of Macquer, that sulphuric acid distilled from the arseniate of potash, disengages the acid of arsenic.

Encouraged by the success which attended his first labours of a chemical nature, he communicated his remarks on the crystallization of sulphur, cinnabar, and the deliquescent salts; the examination of zeolites, particularly the false zeolite of Freyburg, which he discovered to be merely an ore of zinc. He also made observations on the oxygenated muriatic acid, in reference to the absorption of oxygen; on the formation of others, chiefly the muriatic and the acetous; and a number of memoirs on the operation of phosphorus made in the large way; its conversion into phosphoric acid, and its combination with sulphur and most metallic substances.

It was by his operations on phosphorus that he burnt himself so severely as nearly to endanger his life. Immediately on his recovery he began the analysis of different varieties of plumbago from France, England, Germany, Spain, and America, and gave both novelty and interest to his work, even after the labours of Scheele on the same subject had made their appearance. The analysis of carbonate of barytes led him to make experiments on animals, from which he discovered that this earth is a real poison, in whatever way administered. Strontites was also analysed by this celebrated chemist, which was found to contain a new earth.

Pelletier discovered a process for preparing verditer in the large way, equal, it is said, in beauty to that which is manufactured in England. He was also among the first who shewed the possibility of refining bell metal, and separating the tin. His first experiments were performed at Paris, after which he went to the foundery at Romilly, to prove their accuracy in the large way. He was soon after this admitted a member of the Academy of Sciences at Paris, and afterwards accompanied Borda and General Daboville to La Fere, to assist in experiments on a new species of gunpowder. Being obliged to pass great part of the day in the open air during a cold and moist season, in order to render his experiments more decisive, his health, which was naturally delicate, was very much impaired. He partly recovered it, but again fell a victim to his thirst after knowledge, for he was at one time nearly destroyed by inspiring the oxygenated muriatic acid gas, which occasioned a convulsive asthma, which at times appeared to abate, but was found to be incurable. The assistance of art was insufficient to save him, and he died at Paris on the 21st of July 1797, of a pulmonary consumption, in the flower of his age, being only 36.

PELLETS, in *Heraldry*, those roundles that are black; called also *ogresses* and *gunstones*, and by the French *torteaux de sable*.

PELLICLE, among physicians, denotes a thin film or fragment of a membrane. Among chemists it signifies a thin surface of crystals uniformly spread over a saline liquor evaporated to a certain degree.

PELLISON, or PELLISON FONTANIER, PAUL, one of the finest geniuses of the 17th century, was the son of James Pellison counsellor at Castres. He was born at Beziers in 1624, and educated in the Protestant religion. He studied with success the Latin, Greek, French, Spanish, and Italian tongues, and applied himself to the reading the best authors in these languages; after which he studied the law at Castres with reputation. In 1652 he purchased the post of secretary to the king, and five years after became first deputy to M. Fouquet. He suffered by the disgrace of that minister; and in 1661 was confined in the Bastile, from whence he was not discharged till four years after. During his confinement he applied himself to the study of controversy; and in 1670 abjured the Protestant religion. Louis XIV. bestowed upon him an annual pension of 2000 crowns; and he likewise enjoyed several posts. In 1676 he had the abbey of Giment, and some years after the priory of St Orens at Auch. He died in 1693. His principal works are, 1. The History of the French Academy. 2. Reflections on religious Disputes, &c. in 4 vols. 12mo. 3. The History of Louis XIV. 4. Historical Letters and Miscellanies, in 3 vols. 12mo.

PELOPIA, a festival observed by the Eleans in honour of Pelops. A ram was sacrificed on the occasion, which both priests and people were prohibited from partaking of, on pain of excommunication from Jupiter's temple: the neck only was allotted to the officer who provided wood for the sacrifice. This officer was called Ξυλευς; and white poplar was the only wood made use of at this solemnity.

PELOPONNESUS, (Dionysius), a large peninsula to the south of the rest of Greece; called, as it were *Pelopis nesus*, or *insula*, though properly not an island, but a peninsula; yet wanting but little to be one, viz. the isthmus of Corinth, ending in a point like the leaf of the platane or plane tree. Anciently called *Apia* and *Pelasgia*; a peninsula second to no other country for nobleness; situated between two seas, the Egean and Ionian, and resembling a platane-leaf, on account of its angular recesses or bays, (Pliny, Strabo, Mela). Strabo adds from Homer, that one of its ancient names was *Argos*, with the epithet *Achaicum*, to distinguish it from Thessaly, called *Pelasgicum*. Divided into six parts; namely, Argolis, Laconica, Messenia, Elis, Achaia, and Arcadia, (Mela). Now called the *Morea*.

PELOPS, in fabulous history, the son of Tantalus king of Phrygia, went into Elis, where he married Hippodamia the daughter of Oenomaus king of that country; and became so powerful, that all the territory which lies beyond the isthmus, and composes a considerable part of Greece, was called *Peloponnesus*, that is, the *island of Pelops*, from his name and the word Νησος.

PELTA, a small, light, manageable buckler, used by the ancients. It was worn by the Amazons. The pelta is said by some to have resembled an ivy leaf in form; by others it is compared to the leaf of an Indian fig-tree; and by Serbius to the moon in her first quarter.

PELTARIA, a genus of plants belonging to the tetradynamia class, and in the natural method ranked under the 39th order, *Siliquosæ*. See BOTANY *Index*.

PELUSIUM, in *Ancient Geography*, a strong city of Egypt, without the Delta, distant 20 stadia from the sea; situated amidst marshes; and hence its name and its strength. Called the *key* or *inlet of Egypt* (Diodorus, Hirtius); which being taken, the rest of Egypt lay quite open and exposed to an enemy. Called *Sin* (Ezekiel). *Pelusiacus* the epithet (Virgil, Diodorus). From its ruins arose Damietta. E. Long. 32°. N. Lat. 31°.

Letters on Egypt.

Mr Savary gives us the following account of this place: "The period of its foundation, as well as that of the other ancient cities of Egypt, is lost in the obscurity of time. It flourished long before Herodotus. As it commanded the entrance of the country on the side of Asia, the Pharaohs rendered it a considerable fortress: one of them raised a rampart of 30 leagues in length from the walls of this town to Heliopolis. But we find from the history of nations that the long wall of China, those which the weakness of the Greek emperors led them to build round Constantinople, and many others, built at an immense expence, were but feeble barriers against a warlike people: these examples have taught us, that a state, to be in security against a foreign yoke, must form warriors within itself, and that men must be opposed to men. This rampart which covered Pelusium, did not stop Cambyses, who attacked it with a formidable army. The feeble character of the son of Amasis, unable to prevent the desertion of 200,000 Egyptians, who went to found a colony beyond the cataracts, had not force sufficient to oppose that torrent which broke in upon his country. Cambyses, after a bloody battle, wherein he cut his enemies to pieces, entered Pelusium in triumph. That memorable day, which saw the desertion of one part of the Egyptian militia and the ruin of the other, is the true epoch of the subjugation of that rich country. Since that period, it has passed under the yoke of the Persians, the Macedonians, the Romans, the Greeks, the Arabs, and the Turks. A

Pelusium || Pembroke.

continued slavery of more than 2000 years seems to secure them an eternal bondage.

"Herodotus, who visited Pelusium some years after the conquest of Cambyses, relates an anecdote which I cannot omit: 'I surveyed (says he) the plain where the two armies had fought. It was covered with human bones collected in heaps. Those of the Persians were on one side, those of the Egyptians on the other, the inhabitants of the country having taken care to separate them after the battle. They made me take notice of a fact which would have appeared very astonishing to me without their explanation of it. The skulls of the Persians, which were slight and fragile, broke on being lightly struck with a stone; those of the Egyptians, thicker and more compact, resisted the blows of flint. This difference of solidity they attributed to the custom the Persians have of covering their heads from their infancy with the tiara, and to the Egyptian custom of leaving the heads of their children bare and shaved, exposed to the heat of the sun. This explanation appeared satisfactory to me.' Mr Savary assures us that the same customs still subsist in Egypt, of which he frequently had ocular demonstration.

"Pelusium (continues he), after passing under the dominion of Persia, was taken by Alexander. The brave Antony, general of cavalry under Gabinius, took it from his successors, and Rome restored it to Ptolemy Auletes. Pompey, whose credit had established this young prince on the throne of Egypt, after the fatal battle of Pharsalia took refuge at Pelusium. He landed at the entrance of the harbour; and, on quitting his wife Cornelia and his son, he repeated the two following verses of Sophocles, 'The free man who seeks an asylum at the court of a king will meet with slavery and chains.' He there found death. Scarcely had he landed on the shore, when Theodore the rhetorician, of the isle of Chio, Septimius the courtier, and Achillas the eunuch, who commanded his troops, wishing for a victim to present to his conqueror, stabbed him with their swords. At the sight of the assassins Pompey covered his face with his mantle, and died like a Roman. They cut off his head, and embalmed it, to offer it to Cæsar, and left his body naked on the shore. It was thus that this great man, whose warlike talents had procured the liberty of the seas for the Romans, and added whole kingdoms to their extended empire, was basely slain in setting foot on the territory of a king who owed to him his crown. Philip his freedman, collecting together, under favour of the night, the wreck of a boat, and stripping off his own cloak to cover the sad remains of his master, burnt them according to the custom. An old soldier, who had served under Pompey's colours, came to mingle his tears with those of Philip, and to assist him in performing the last offices to the manes of his general.—Pelusium was often taken and pillaged during the wars of the Romans, the Greeks, and the Arabs. But in spite of so many disasters, she preserved to the time of the Crusades her riches and her commerce. The Christian princes having taken it by storm, sacked it. It never again rose from its ruins; and the inhabitants went to Damietta." See DAMIETTA.

PELVIS, in *Anatomy*. See ANATOMY *Index*.

PEMBROKE, MARY, COUNTESS OF. See HERBERT.

PEMBROKE, in Pembrokeshire, in England, is the principal town in the county. It is situated upon a creek of Milford-Haven, and in the most pleasant part of Wales, being about 256 miles distant from London. It is the county-town, and has two handsome bridges over two small rivers which run into a creek, forming the west side of a promontory. It is well inhabited, has several good houses, and but one church. There is also a customhouse in it. There are several merchants in it, who, favoured by its situation, employ near 200 sail on their own account; so that, next to Caermarthen, it is the largest and richest town in South Wales. It has one long straight street, upon a narrow part of a rock; and the two rivers seem to be two arms of Milford-Haven, which ebbs and flows close up to the town. It was in former times fortified with walls, and a magnificent castle seated on a rock at the west end of the town. In this rock, under the chapel, is a natural cavern called *Wogan*, remarked for having a very fine echo: this is supposed to have been a store-room for the garrison, as there is a staircase leading into it from the castle. This structure being burnt a few years after it was erected, it was rebuilt. It is remarkable for being the birth-place of Henry VII. and for the brave defence made by the garrison for Charles I. The inhabitants in 1811 amounted to 2415.

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PEMBROKESHIRE, a county of Wales, bounded on all sides by the Irish sea, except on the east, where it joins to Caermarthenshire, and on the north-east to Cardiganshire. It lies the nearest to Ireland of any county in Wales; and extends in length from north to south 35 miles, and from east to west 29, and is about 140 in in circumference. It is divided into seven hundreds; contains about 420,000 acres, one city, eight market-towns, two forests, 145 parishes. In 1811 it contained 12,874 houses, and 60,615 inhabitants, of whom 15,557 lived in towns, and 45,058 in the country. It lies in the province of Canterbury, and diocese of St David's. It sends three members to parliament, viz. one for the shire, one for Haverfordwest, and one for the town of Pembroke.

The air of Pembrokeshire, considering its situation, is good; but it is in general better the farther from the sea. As there are but few mountains, the soil is generally fruitful, especially on the sea-coasts; its mountains also maintain great numbers of sheep and goats. Its other commodities are corn, cattle, pit-coal, marl, fish, and fowl. Among these last are falcons, called here *peregrines*. Amongst the birds common here are migratory sea-birds, that breed in the isle of Ramsey, and the adjoining rocks called *The Bishop and his Clerks*. About the beginning of April such flocks of sea-birds, of several kinds, resort to these rocks, as appear incredible to those who have not seen them.

The inhabitants of this county make a very pleasant durable fire of culm, which is the dust of coal made up into balls with a third part of mud. The county is well watered by the rivers Clethy, Dougledy, Cledhew, and Teive; which last parts it from Cardiganshire. There is a division of the county styled *Rhos* in the Welsh, by which is meant a large green plain. This is inhabited by the descendants of the Flemings, placed there by Henry I. to curb the Welch, who were never able to expel them, though they often attempted it. On the coasts of this county, as well as on those of Glamorganshire and the Severn sea, is found a kind of alga or laver, which is gathered in spring; and of which the inhabitants make a sort of food, called in Welch *lhavan*, and in English *black butter*. Having washed it clean, they lay it to sweat between two flat stones, then shred it small, and knead it well, like dough for bread, and then make it up into great balls or rolls, which is by some eaten raw, and by others fryed with oatmeal and butter. It is accounted excellent against many distempers. See PEMBROKESHIRE, SUPPLEMENT.

PEN, a town of Somersetshire, in England, on the north-east side of Wincaunton, where Kenwald a West Saxon king so totally defeated the Britons, that they were never after able to make head against the Saxons; and where, many ages after this, Edmund Ironside gained a memorable victory over the Danes, who had before, i. e. in 1001, defeated the Saxons in that same place.

PEN, a little instrument, usually formed of a quill, serving to write withal.

Pens are also sometimes made of silver, brass, or iron.

Dutch PENS, are made of quills that have passed through hot ashes, to take off the grosser fat and moisture, and render them more transparent.

Fountain PEN, is a pen of silver, brass, &c. contrived to contain a considerable quantity of ink, and let it flow out by gentle degrees, so as to supply the writer a long time without being under the necessity of taking fresh ink.

Plate CCCCVII. fig. 1.

The fountain pen is composed of several pieces. The middle piece, fig. 1. carries the pen, which is screwed into the inside of a little pipe, which again is soldered to another pipe of the same bigness as the lid, fig. 2.; in which lid is soldered a male screw, for screwing on the cover, as also for stopping a little hole at the place and hindering the ink from passing through it. At the other end of the piece, fig. 1. is a little pipe, on the outside of which the top-cover, fig. 3. may be screwed. In the cover there goes a port-crayon, which is to be screwed into the last-mentioned pipe, in order to stop the end of the pipe, into which the ink is to be poured by a funnel. To use the pen, the cover fig. 2. must be taken off, and the pen a little shaken, to make the ink run more freely.

There are, it is well known, some instruments used by practical mathematicians, which are called *pens*, and which are distinguished according to the use to which they are principally applied; as for example, the drawing pen, &c. an instrument too common to require a particular description in this place. But it may be proper to take some notice of the geometric pen, as it is not so well known, nor the principles on which it depends so obvious.

The *geometric PEN* is an instrument in which, by a circular motion, a right line, a circle, an ellipse, and other mathematical figures, may be described. It was first invented and explained by John Baptist Suardi, in a work intitled *Nuovo Instromenti per la Descrizzione di diverse Curve Antichi e Moderne*, &c. Several writers had observed the curves arising from the compound motion of two circles, one moving round the other; but Suardi first realized the principle, and first reduced it to practice. It has been lately introduced with success into the steam-engine by Watt and Bolton. The number of curves this instrument can describe is truly amazing; the author enumerates not less than 1273, which (he says) can be described by it in the simple form. We shall give a short description of it from Adam's Geometrical and Graphical Essays.

Plate CCCCVII. fig. 1.

Fig. 1. represents the geometric pen; A, B, C, the stand by which it is supported; the legs A, B, C, are contrived to fold one within the other for the convenience of packing. A strong axis D is fitted to the top of the frame; to the lower part of this axis any of the wheels (as *i*) may be adapted; when screwed to it they are immoveable. EG is an arm contrived to turn round upon the main axis D; two sliding boxes are fitted to this arm; to these boxes any of the wheels belonging to the geometric pen may be fixed, and then slid so that the wheels may take into each other and the immoveable wheel *i*; it is evident, that by making the arm EG revolve round the axis D, these wheels will be made to revolve also, and that the number of their revolutions will depend on the proportion between the teeth. F*g* is an arm carrying the pencil; this arm slides backwards and forwards in the box *c d*, in order that the distance of the pencil from the centre of the wheel *h* may be easily varied; the box *c d* is fitted to the axis of the wheel *h*, and turns round with it, carrying the arm *f g* along with it: it is evident, therefore, that the revolutions will be fewer or greater in proportion to the difference between the numbers of the teeth in the wheels *h* and *i*; this bar and socket are easily removed for changing the wheels. When two wheels only are used, the bar *f g* moves in the same direction with the bar EG; but if another wheel is introduced between them, they move in contrary directions.

"The number of teeth in the wheels, and consequently the relative velocity of the epicycle or arm *f g*, may be varied *in infinitum*. The numbers we have used are 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96.

"The construction and application of this instrument is so evident from the figure, that nothing more need be pointed out than the combinations by which various figures may be produced. We shall take two as examples:

"The radius of EG (fig. 2.) must be to that of *f g* as 10 to 5 nearly; their velocities, or the number of teeth in the wheels, to be equal; the motion to be in the same direction. Fig. 2.

"If the length of *f g* be varied, the looped figure delineated at fig. 3. will be produced. A circle may be described by equal wheels, and any radius but the bars must move in contrary directions. Fig. 3.

"*To describe by this circular motion a straight line and an ellipsis.* For a straight line, equal radii, the velocity as 1 to 2, the motion in a contrary direction; the same data will give a variety of ellipses, only the radii must be unequal; the ellipses may be described in any direction." See fig. 4. Fig. 4.

PEN, or *Penstock*. See PENSTOCK.

Sea-PEN. See PENNATULA, HELMINTHOLOGY *Index*.

PENANCE, a punishment, either voluntary or imposed by authority, for the faults a person has committed. Pennance is one of the seven sacraments of the Romish church. Besides fasting, alms, abstinence, and the like, which are the general conditions of penance, there are others of a more particular kind; as the repeating a certain number of ave-marys, pater-nosters, and credos, wearing a hair-shirt, and giving one's self a certain number of stripes. In Italy and Spain it is usual to see Christians almost naked, loaded with chains and a cross, and lashing themselves at every step.

PENATES, in Roman antiquity, a kind of tutelar deities, either of countries or particular houses; in which last sense they differed in nothing from the lares. See LARES.

The penates were properly the tutelar gods of the Trojans, and were only adopted by the Romans, who gave them the title of *penates*.

PENCIL, an instrument used by painters for laying on their colours. Pencils are of various kinds, and made of various materials; the largest sorts are made of boars bristles, the thick ends of which are bound to a stick, bigger, or less according to the uses they are designed for; these, when large, are called *brushes*. The finer sorts of pencils are made of camels, badgers, and squirrels hair, and of the down of swans; these are tied at the upper end with a piece of strong thread, and enclosed in the barrel of a quill.

All good pencils, on being drawn between the lips, come to a fine point.

PENCIL, is also an instrument used in drawing, writing, &c. made of long pieces of black lead or red chalk, placed in a groove cut in a slip of cedar; on which other pieces of cedar being glued, the whole is planed round, and one of the ends being cut to a point, it is fit for use.

Black lead in fine powder, stirred into melted sulphur, unites with it so uniformly, and in such quantity, in virtue perhaps of its abounding with sulphur, that though the compound remains fluid enough to be poured into moulds, it looks nearly like the coarser sorts of black lead itself. Probably the way which Prince Rupert is said to have had, mentioned in the third volume of Dr Birch's History of the Royal Society, of making black lead run like a metal in a mould, so as to serve for black lead again, consisted in mixing with it sulphur or sulphureous bodies.

On this principle the German black lead pencils are said to be made; and many of those which are hawked about by certain persons among us are prepared in the same manner: their melting or softening, when held to a candle, or applied to a red-hot iron, and yielding a bluish flame, with a strong smell like that of burning brimstone, betrays their composition; for black lead itself yields no smell or fume, and suffers no apparent alteration in that heat. Pencils made with such additions are of a very bad kind; they are hard, brittle, and do not cast or make a mark freely either on paper or wood, rather cutting or scratching them than leaving a coloured stroke.

The true English pencils (which Vogel in his mineral system, and some other foreign writers, imagine to be prepared also by melting the black lead with some additional substances, and casting it into a mould) are formed of black lead alone sawed into slips, which are fitted into a groove made in a piece of wood, and another slip of wood glued over them: the softest wood, as cedar, is made choice of, that the pencil may be the easier cut; and a part at one end, too short to be conveniently used after the rest has been worn and cut away, is left unfilled with the black lead, that there may be no waste of so valuable a commodity. These pencils are greatly preferable to the others, though seldom so perfect as could be wished, being accompanied with some degree of the same inconveniences, and being very unequal in their quality, on account of different sorts of the mineral being fraudulently joined together in one pencil, the fore part being commonly pretty good, and the rest of an inferior kind. Some, to avoid these imperfections, take the finer pieces of black lead itself, which they saw into slips, and fix for use in port crayons: this is doubtless the surest way of obtaining black lead crayons, whose goodness can be depended on.

PENDANT, an ornament hanging at the ear, frequently composed of diamonds, pearls, and other jewels.

PENDANTS, in *Heraldry*, parts hanging down from the label to the number of three, four, five, or six at most, resembling the drops in the Doric frieze. When they are more than three, they must be specified in blazoning.

PENDANTS of a Ship, are those streamers, or long colours, which are split and divided into two parts, ending in points, and hung at the head of masts, or at the yard-arm ends

PENDENE-VOW, in Cornwall, in England, on the north coast, by Morvath. There is here an unfathomable cave under the earth, into which the sea flows at high water. The cliffs between this and St Ives shine as if they had store of copper, of which indeed there is abundance within land.

PENDENNIS, in Cornwall, at the mouth of Falmouth haven, is a peninsula of a mile and a half in compass. On this Henry VIII. erected a castle, opposite to that of St Maw's, which he likewise built. It was fortified by Queen Elizabeth, and served then for the governor's house. It is one of the largest castles in Britain, and is built on a high rock. It is stronger by land than St Maw's, being regularly fortified, and having good outworks.

PENDULOUS, a term applied to any thing that bends or hangs downwards.

PENDULUM, a vibrating body suspended from a fixed point. For the history of this invention, see the article CLOCK.

The theory of the pendulum depends on that of the inclined plane. Hence, in order to understand the nature of the pendulum, it will be necessary to premise some of the properties of this plane; referring, however, to *Inclined PLANE*, and to the article MECHANICS, for the demonstration.

Plate CCCCVIII. fig. 1.

I. Let AC (fig. 1.) be an inclined plane, AB its perpendicular height, and D any heavy body: then the force which impels the body D to descend along the inclined plane AC, is to the absolute force of gravity as the height of the plane AB is to its length AC; and the motion of the body will be uniformly accelerated.

II. The velocity acquired in any given time by a body descending on an inclined plane AC, is to the velocity acquired in the same time by a body falling freely and perpendicularly, as the height of the plane AB to its length AC. The final velocities will be the same; the spaces described will be in the same ratio; and the times of description are as the spaces described.

III. If a body descend along several contiguous planes, AB, BC, CD, (fig. 2.) the final velocity, namely, that at the point D, will be equal to the final velocity in descending through the perpendicular AE, the perpendicular heights being equal. Hence, if these planes be supposed indefinitely short and numerous, they may be conceived to form a curve, and therefore the final velocity acquired by a body in descending through any curve AF, will be equal to the final velocity acquired in descending through the planes AB, BC, CD, or to that in descending through AE, the perpendicular heights being equal.

IV. If from the upper or lower extremity of the vertical diameter of a circle a cord be drawn, the time of descent along this cord will be equal to the time of descent through the vertical diameter; and therefore the times of descent through all cords in the same circle, drawn from the extremity of the vertical diameter, will be equal.

V. The times of descent of two bodies through two planes equally elevated will be in the subduplicate ratio of the lengths of the planes. If, instead of one plane, each be composed of several contiguous planes similarly placed, the times of descent along these planes will be in the same ratio. Hence, also, the times of describing similar arches of circles similarly placed will be in the subduplicate ratio of the lengths of the arches.

VI. The same things hold good with regard to bodies projected upward, whether they ascend upon inclined planes or along the arches of circles.

The point or axis of suspension of a pendulum is that point about which it performs its vibrations, or from which it is suspended.

The centre of oscillation is a point in which, if all the matter in a pendulum were collected, any force applied at this centre would generate the same angular velocity in a given time as the same force when applied at the centre of gravity.

The length of a pendulum is equal to the distance between the axis of suspension and centre of oscillation.

Fig. 3. Let PN (fig. 3.) represent a pendulum suspended from the point P; if the lower part N of the pendulum be raised to A, and let fall, it will by its own gravity descend through the circular arch AN, and will have acquired the same velocity at the point N that a body would acquire in falling perpendicularly from C to F, and will endeavour to go off with that velocity in the tangent ND; but being prevented by the rod or cord, will move through the arch NB to B, where, losing all its velocity, it will by its gravity descend through the arch BN, and, having acquired the same velocity as before, will ascend to A. In this manner it will continue its motion forward and backward along the arch ANB, which is called an *oscillatory* or *vibratory* motion; and each swing is called a *vibration*.

PROP. I. If a pendulum vibrates in very small circular arches, the times of vibration may be considered as equal, whatever be the proportion of the arches.

Fig. 4. Let PN (fig. 4.) be a pendulum; the time of describing the arch AB will be equal to the time of describing CD; these arches being supposed very small.

Join AN, CN; then since the times of descent along all cords in the same circles, drawn from one extremity of the vertical diameter, are equal; therefore the cords AN, CN, and consequently their doubles, will be described in the same time; but the arches AN, CN being supposed very small, will therefore be nearly equal to their cords: hence the times of vibrations in these arches will be nearly equal.

PROP. II. Pendulums which are of the same length vibrate in the same time, whatever be the proportion of their weights.

This follows from the property of gravity, which is always proportional to the quantity of matter, or to its inertia. When the vibrations of pendulums are compared, it is always understood that the pendulums describe either similar finite arcs, or arcs of evanescent magnitude, unless the contrary is mentioned.

PROP. III. If a pendulum vibrates in the small arc of a circle, the time of one vibration is to the time of a body's falling perpendicularly through half the length of the pendulum, as the circumference of a circle is to its diameter.

Let PE (fig. 5.) be the pendulum which describes the arch ANC in the time of one vibration; let PN be perpendicular to the horizon, and draw the cords AC, AN; take the arc E*e* infinitely small, and draw EFG, *efg* perpendicular to PN, or parallel to AC; describe the semicircle BGN, and draw *er*, *gs* perpendicular to EG: now let $t=$ time of descending through the diameter 2PN, or through the cord AN: Then the velocities gained by falling through 2PN, and by the pendulum's descending through the arch AE, will be as $\sqrt{2PN}$ and $\sqrt{BF}$; and the space described in the time *t*, after the fall through 2PN, is 4PN. But the times are as the spaces divided by the velocities. Fig. 5.

Therefore $\frac{4PN}{\sqrt{2PN}}$ or $2\sqrt{2PN} : t :: \frac{Ee}{\sqrt{BF}}$: time of describing $Ee=\frac{t\times Ee}{2\sqrt{2PN}\times BF}$. But in the similar triangles PEF, E*er*, and KGF, G*gs*,

$$\text{As } PE=PN : EF :: Ee : er=\frac{EF}{PN}\times Ee;$$

$$\text{And } KG=KD : FG :: Gg : Gs=\frac{FG}{KD}\times Gg.$$

$$\text{But } er=Gs;\ \text{therefore } \frac{EF}{PN}\times Ee=\frac{FG}{KD}\times Gg.$$

$$\text{Hence } Ee=\frac{PN\times FG}{KD\times EF}\times Gg.$$

And by substituting this value of E*e* in the former equation, we have the time of describing $Ee=\frac{t\times PN\times FG\times Gg}{2KD\times EF\times\sqrt{BF\times 2PN}}$: But by the nature of the circle $FG=\sqrt{BF\times FN}$, and $EF=\sqrt{PN+PF+FN}$. Hence, by substitution, we obtain the time of describing

$$Ee=\frac{t\times PN\times\sqrt{BF\times FN}\times Gg}{2KD\times\sqrt{PN+PF\times FN}\times\sqrt{BF\times 2PN}}=\frac{t\times\sqrt{PN}\times Gg}{2KD\times\sqrt{PN+PF}\times\sqrt{2}}=\frac{t\times\sqrt{2PN}\times Gg}{4KD\times\sqrt{PN+PF}}=\frac{t\times\sqrt{2PN}}{2BN\times\sqrt{2PN-NF}}\times Gg.$$

But NF, in its mean quantity for all the arches Gg, is nearly equal to NK; for if the semicircle described on the diameter BN, which corresponds to the whole arch AN, be divided into an indefinite number of equal arches, Gg, &c. the sum of all the lines NF, will be equal to as many times NK, as there are arches in the semicircle equal to Gg; therefore the time of describing $Ee = \frac{t \times \sqrt{2PN}}{2BN + \sqrt{2PN - NK}} \times Gg$. Whence the time of describing the arch AED $= \frac{t \times \sqrt{2PN}}{2BN \times \sqrt{2PN - NK}} \times BGN$; and the time of describing the whole arch ADC, or the time of one vibration, is $= \frac{t \times \sqrt{2PN}}{2BN \times \sqrt{2PN - NK}} \times 2BGN$. But when the arch ANC is very small, NK vanishes, and then the time of vibration in a very small arc is $= \frac{t \times \sqrt{2PN}}{2BN \times \sqrt{2PN}} \times 2BGN = \frac{1}{2} t \times \frac{2BGN}{BN}$. Now if t be the time of descent through 2 PN; then since the spaces described are as the squares of the times, $\frac{1}{2} t$ will be the time of descent through $\frac{1}{2}$PN: therefore the diameter BN is to the circumference 2BGN, as the time of falling through half the length of the pendulum is to the time of one vibration.

Prop. IV. The length of a pendulum vibrating seconds is to twice the space through which a body falls in one second, as the square of the diameter of a circle is to the square of its circumference.

Let $d =$ diameter of a circle $= 1$, $c =$ circumference $= 3.14159$, &c. t to the time of one vibration, and p the length of the corresponding pendulum; then by the last proposition $c : d :: 1'' : \frac{d}{c} =$ time of falling through half the length of the pendulum. Let $s =$ space described by a body falling perpendicularly in the first second: then since the spaces described are in the subduplicate ratio of the times of description, therefore $1'' : \frac{d}{c} :: \sqrt{s} : \sqrt{\frac{1}{2} p}$. Hence $c^2 : d^2 :: 2s : p$.

It has been found by experiment, that in latitude $51\frac{1}{2}°$ a body falls about 16.11 feet in the first second: hence the length of a pendulum vibrating seconds in that latitude is $= \frac{32.22}{\overline{3.14159}|^2} =$ 3 feet 3.174 inches.

Prob. V. The times of the vibrations of two pendulums in similar arcs of circles are in a subduplicate ratio of the lengths of the pendulums.

Fig. 6.

Let PN, PO (fig. 6.) be two pendulums vibrating in the similar arcs AB, CD; the time of a vibration of the pendulum PN is to the time of a vibration of the pendulum PO in a subduplicate ratio of PN to PO.

Since the arcs AN, CO are similar and similarly placed, the time of descent through AN will be to the time of descent through CO in the subduplicate ratio of AN to CO: but the times of descent through the arcs AN and CO are equal to half the times of vibration of the pendulums PN, PO respectively. Hence the time of vibration of the pendulum PN in the arc AB is to the time of vibration of the pendulum PO in the similar arc CD in the subduplicate ratio of AN to CO: and since the radii PN, PO are proportional to the similar arcs AN, CO, therefore the time of vibration of the pendulum PN will be to the time of vibration of the pendulum PO in a subduplicate ratio of PN to PO.

If the length of a pendulum vibrating seconds be 39.174 inches, then the length of a pendulum vibrating half seconds will be 9.793 inches. For $1'' : \frac{1}{2}'' :: \sqrt{39.174} : \sqrt{x}$; and $1 : \frac{1}{4} :: 39.174 : x$. Hence $x = \frac{39.174}{4} = 9.793$.

Prop. VI. The lengths of pendulums vibrating in the same time, in different places, will be as the forces of gravity.

For the velocity generated in any given time is directly as the force of gravity, and inversely as the quantity of matter. Now the matter being supposed the same in both pendulums, the velocity is as the force of gravity; and the space passed through in a given time will be as the velocity; that is, as the gravity.

Cor. Since the lengths of pendulums vibrating in the same time in small arcs are as the gravitating forces, and as gravity increases with the latitude on account of the spheroidal figure of the earth and its rotation about its axis; hence the length of a pendulum vibrating in a given time will be variable with the latitude, and the same pendulum will vibrate slower the nearer it is carried to the equator.

Prop. VII. The time of vibrations of pendulums of the same length, acted upon by different forces of gravity, are reciprocally as the square roots of the forces.

For when the matter is given, the velocity is as the force and time; and the space described by any given force is as the force and square of the time. Hence the lengths of pendulums are as the forces and the squares of the times of falling through them. But these times are in a given ratio to the times of vibration; whence the lengths of pendulums are as the forces and the squares of the times of vibration. Therefore, when the lengths are given, the forces will be reciprocally as the square of the times, and the times of vibration reciprocally as the square roots of the forces.

Cor. Let $p =$ length of pendulum, $g =$ force of gravity, and $t =$ time of vibration. Then since $p = g \times t^2$. Hence $g = p \times \frac{1}{t^2}$; and $t = \sqrt{p \times \frac{1}{g}}$.

That is, the forces in different places are directly as the lengths of the pendulums, and inversely as the square roots of the times of vibration; and the times of vibration are directly as the square roots of the lengths of the pendulums, and inversely as the square roots of the gravitating forces.

Prop. VIII. A pendulum which vibrates in the arch of a cycloid describes the greatest and least vibrations in the same time.

This property is demonstrated only on a supposition that the whole mass of the pendulum is concentrated in a point: but this cannot take place in any really vibrating body; and when the pendulum is of finite magnitude, there is no point given in position which determines the length of the pendulum; on the contrary the centre of oscillation will not occupy the same place in the given body, when describing different parts of the tract it moves through, but will continually be moved in respect of the pendulum itself during its vibration. I may, however, be observed, that Huyghens, aware tha a pendulum ball suspended at the end of a thread vibrating between cycloids, would not describe a cycloid with its centre of oscillation, gave a very beautiful and simple method of suspension, which secured its vibrations in that curve. Harrison, whose authority is next, insists on the advantage of wide vibrations, and in his own clocks, he always used cycloidal checks. This circumstance has prevented any general determination of the time of vibration in a cycloidal arc, except in the imaginary case referred to.

There are many other obstacles which concur in rendering the application of this curve to the vibration of pendulums designed for the measures of time the source of errors far greater than those which by its peculiar property it is intended to obviate; and it is now wholly disused in practice.

Although the times of vibration of a pendulum in different arches be nearly equal, yet from what has been said, it will appear, that if the ratio of the least of these arches to the greatest be considerable, the vibrations will be formed in different times; and the difference, though small, will become sensible in the course of one or more days. In clocks used for astronomical purposes, it will therefore be necessary to observe the arc of vibration; which if different from that described by the pendulum when the clock keeps time, there a correction must be applied to the time shown by the clock. This correction, expressed in seconds of time, will be equal to the half of three times the difference of the square of the given arc, and that of the arc described by the pendulum when the clock keeps time, these arcs being expressed in degrees; and so much will the clock gain or lose according as the first of these arches is less or greater than the second.

Thus, if a clock keep time when the pendulum vibrates in the arch of 3°, it will lose $10\frac{1}{2}$ seconds daily in an arch of 4 degrees.

For $\overline{4^2-3^2} \times \frac{3}{2} = 7 \times \frac{3}{2} = 10\frac{1}{2}$ seconds.

The length of a pendulum rod increases with heat; and the quantity of expansion answering to any given degree of heat is experimentally found by means of a pyrometer†; but the degree of heat at any given time is shown by a thermometer: hence that instrument should be placed within the clock case at a height nearly equal to that of the middle of the pendulum; and its height, for this purpose, should be examined at least once a day. Now by a table constructed to exhibit the daily quantity of acceleration or retardation of the clock answering to every probable height of the thermometer, the corresponding correction may be obtained. It is also necessary to observe, that the mean height of the thermometer during the interval ought to be used. In Six's thermometer this height may be easily obtained; but in thermometers of the common construction it will be more difficult to find this mean.

† See Pyrometer, Chemistry *Index*.

It had been found, by repeated experiments, that a brass rod equal in length to a second pendulum will expand or contract $\frac{1}{1000}$ part of an inch by a change of temperature of one degree in Fahrenheit's thermometer; and since the times of vibration are in a subduplicate ratio of the lengths of the pendulum, hence an expansion or contraction of $\frac{1}{1000}$ part of an inch will answer nearly to one second daily; therefore a change of one degree in the thermometer will occasion a difference in the rate of the clock equal to one second daily. Whence, if the clock be so adjusted as to keep time when the thermometer is at 55°, it will lose 10 seconds daily when the thermometer is at 65°, and gain as much when it is at 45°.

Hence the daily variation of the rate of the clock from summer to winter will be very considerable. It is true indeed that most pendulums have a nut or regulator at the lower end, by which the bob may be raised or lowered a determinate quantity; and therefore while the height of the thermometer is the same, the rate of the clock will be uniform. But since the state of the weather is ever variable, and as it is impossible to be raising or lowering the bob of the pendulum at every change of the thermometer, therefore the correction formerly mentioned is to be applied. This correction, however, is in some measure liable to a small degree of uncertainty; and in order to avoid it altogether, several contrivances have been proposed by constructing a pendulum of different materials, and so disposing them that their effects may be in opposite directions, and thereby counterbalance each other; and by this means the pendulum will continue of the same length.

Mercurial Pendulum.

Mercurial PENDULUM. The first of these inventions is that by the celebrated Mr George Graham. In this, the rod of the pendulum is a hollow tube, into which a sufficient quantity of mercury is introduced. Mr Graham first used a glass tube, and the clock to which it was applied was placed in the most exposed part of the house. It was kept constantly going, without having the hands or pendulum altered, from the 9th of June 1722 to the 14th of October 1725, and its rate was determined by transits of fixed stars. Another clock made with extraordinary care, having a pendulum about 60 pounds weight, and not vibrating above one degree and a half from the perpendicular, was placed beside the former, in order the more readily to compare them with each other, and that they might both be equally exposed. The result of all the observations was this, that the irregularity of the clock with the quicksilver pendulum exceeded not, when greatest, a sixth part of that of the other clock with the common pendulum, but for the greatest part of the year not above an eighth or ninth part; and even this quantity would have been lessened, had the column of mercury been a little shorter: for it differed a little the contrary way from the other clock, going faster with heat and slower with cold. To confirm this experiment more, about the beginning of July 1723 Mr Graham took off the heavy pendulum from the other clock, and made another with mercury, but with this difference, that instead of a glass tube he used a brass one, and varnished the inside to secure it from being injured by the mercury. This pendulum he used afterwards, and found it about the same degree of exactness as the other.

Philos. Trans. 1726. No 392.

Gridiron Pendulum.

The Gridiron PENDULUM is an ingenious contrivance for the same purpose. Instead of one rod, this pendulum is composed of any convenient number of rods, as five, seven, or nine; being so connected, that the effect of one set of them counteracts that of the other set; and therefore, being properly adjusted to each other, the centres of suspension and oscillation will always be equidistant. Fig. 7. represents a gridiron pendulum composed of nine rods, steel and brass alternately. The two outer rods AB, CD, which are of steel, are fastened to the cross pieces AC, BD by means

Fig. 7.

Pendulum

means of pins. The next two rods, EF, GH, are of brass, and are fastened to the lower bar BD, and to the second upper bar EG. The two following rods are of steel, and are fastened to the cross bars EG and IK. The two rods adjacent to the central rod being of brass, are fastened to the cross pieces IK and LM; and the central rod, to which the ball of the pendulum is attached, is suspended from the cross piece LM, and passes freely through a perforation in each of the cross bars IK, BD. From this disposition of the rods, it is evident that, by the expansion of the extreme rods, the cross piece BD, and the two rods attached to it, will descend: but since these rods are expanded by the same heat, the cross piece EG will consequently be raised, and therefore also the two next rods; but because these rods are also expanded, the cross bar IK will descend; and by the expansion of the two next rods, the piece LM will be raised a quantity sufficient to counteract the expansion of the central rod. Whence it is obvious, that the effect of the steel rods is to increase the length of the pendulum in hot weather, and to diminish it in cold weather, and that the brass rods have a contrary effect upon the pendulum. The effect of the brass rods must, however, be equivalent not only to that of the steel rods, but also to the part above the frame and spring, which connects it with the cock, and to that part between the lower part of the frame and the centre of the ball.

M. Thiout.

Another excellent contrivance for the same purpose is described in a French author on clock-making. It was used in the north of England by an ingenious artist about 40 years ago. This invention is as follows: A bar of the same metal with the rod of the pendulum, and of the same dimensions, is placed against the back part of the clock case; from the top of this a part projects, to which the upper part of the pendulum is connected by two fine pliable chains or silken strings, which just below pass between two plates of brass, whose lower edges will always terminate the length of the pendulum at the upper end. These plates are supported on a pedestal fixed to the back of the case. The bar rests upon an immoveable base at the lower part of the case; and is inserted into a groove, by which means it is always retained in the same position. From this construction, it is evident that the extension or contraction of this bar, and of the rod of the pendulum, will be equal, and in contrary directions. For suppose the rod of the pendulum to be expanded any given quantity by heat; then, as the lower end of the bar rests upon a fixed point, the bar will be expanded upwards, and raise the upper end of the pendulum just as much as its length was increased; and hence its length below the plates will be the same as before.

Of this pendulum, somewhat improved by Mr Crosthwaite watch and clock-maker, Dublin, we have the following description in the Transactions of the Royal Irish Academy, 1788.—"A and B (fig. 8.) are two rods of steel forged out of the same bar, at the same time, of the same temper, and in every respect similar. On the top of B is formed a gibbet C; this rod is firmly supported by a steel bracket D, fixed on a large piece of marble E, firmly set into the wall F, and having liberty to move freely upwards between cross staples of brass, 1, 2, 3, 4, which touch only in a point in front and rear (the staples having been carefully formed for that purpose); to the other rod is firmly fixed by its centre the lens G, of 24 pounds weight, although it should in strictness be a little below it. This pendulum is suspended by a short steel spring on the gibbet at C; all which is entirely independent of the clock. To the back of the clock plate I are firmly screwed two cheeks nearly cycloidal at K, exactly in a line with the centre of the verge L. The maintaining power is applied by a cylindrical steel stud, in the usual way of regulators, at M. Now, it is very evident, that any expansion or contraction that takes place in either of these exactly similar rods, is instantly counteracted by the other; whereas in all *compensation* pendulums composed of different materials, however just calculation may seem to be, that can never be the case, as not only different metals, but also different bars of the same metal, that are not manufactured at the same time, and exactly in the same manner, are found by a good pyrometer to differ materially in their degrees of expansion and contraction, a very small change affecting one and not the other."

Fig. 8.

Fir Pendulum.

The expansion or contraction of straight grained fir wood lengthwise, by change of temperature is so small, that it is found to make very good pendulum rods. The wood called *sapadillo* is said to be still better. There is good reason to believe, that the previous baking, varnishing, gilding, or soaking of these woods in any melted matter, only tends to impair the property that renders them valuable. They should be simply rubbed on the outside with wax and a cloth. In pendulums of this construction the error is greatly diminished, but not taken away.

Angular Pendulum

Angular PENDULUM, is formed of two pieces or legs like a sector, and is suspended by the angular point. This pendulum was invented with a view to diminish the length of the common pendulum, but at the same time to preserve or even increase the time of vibration. In this pendulum, the time of vibration depends on the length of the legs, and on the angle contained between them conjointly, the duration of the time of vibration increasing with the angle. Hence a pendulum of this construction may be made to oscillate in any given time. At the lower extremity of each leg of the pendulum is a ball or bob as usual. It may be easily shown, that in this kind of a pendulum, the squares of the times of vibration are as the secants of half the angle contained by the legs: hence if a pendulum of this construction vibrates half seconds when its legs are close, it will vibrate whole seconds when the legs are opened, so as to contain an angle equal to $151^{\circ}\ 2\frac{1}{8}'$.

Conical or Circular Pendulum.

The Conical or Circular PENDULUM, is so called from the figure described by the string or ball of the pendulum. This pendulum was invented by Mr Huygens, and is also claimed by Dr Hooke.

In order to understand the principles of this pendulum, it will be necessary to premise the following lemma, viz. the times of all the circular revolutions of a heavy globular body, revolving within an inverted hollow paraboloid, will be equal, whatever be the radii of the circle described by that body.

In order, therefore, to construct the pendulum so that its ball may always describe its revolutions in a paraboloid surface, it will be necessary that the rod of the pendulum be flexible, and that it be suspended in

PENDULUM.

PLATE CCCCVIII.

Fig. 1.

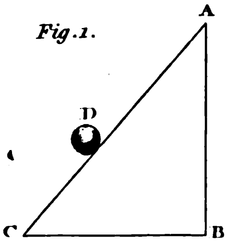


Fig. 2.

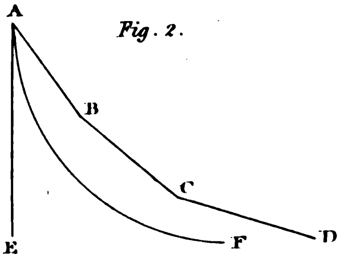


Fig. 8.

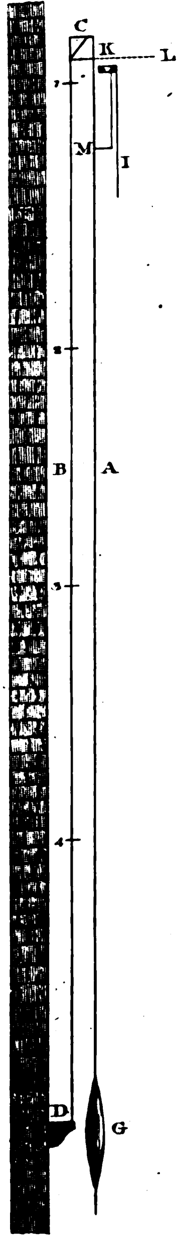


Fig. 7.

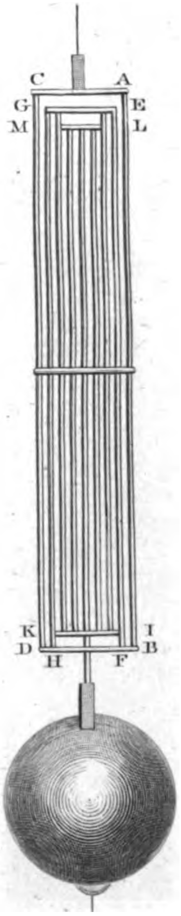


Fig. 3.

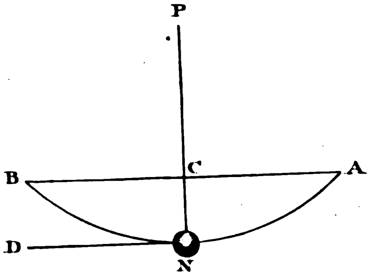


Fig. 4.

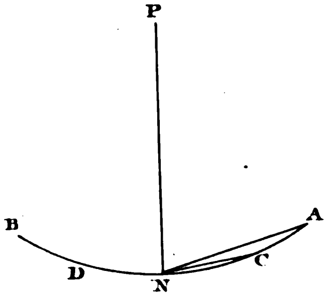


Fig. 5.

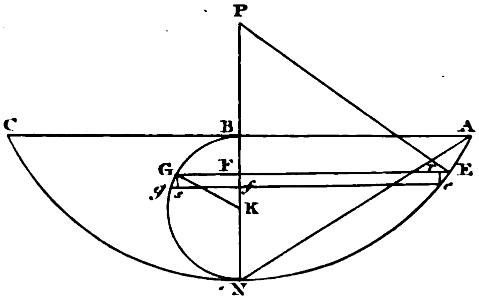


Fig. 6.

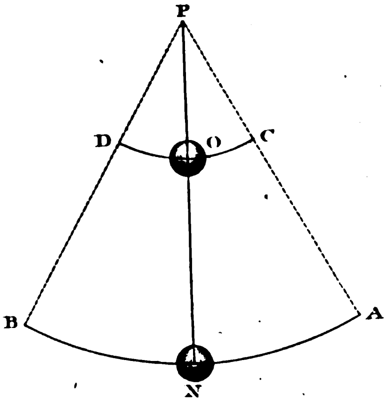
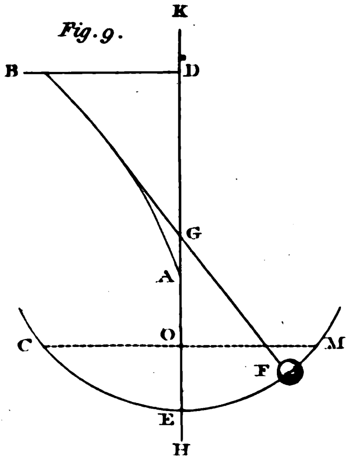


Fig. 9.



W. Archibald Sculp^t.

Fig. 9.

such a manner as to form the evolute of the given parabola. Hence, let KH (fig. 9.) be an axis perpendicular to the horizon, having a pinion at K moved by the last wheel in the train of the clock; and a hardened steel point at H moving in an agate pivot, to render the motion as free as possible. Now, let it be required that the pendulum shall perform each revolution in a second, then the paraboloid surface it moves in must be such whose *latus rectum* is double the length of the common half second pendulum. Let O be the focus of the parabola MEC, and MC the *latus rectum;* and make AE=MO=¼MC = the length of a common half second pendulum. At the point A of the verge, let a thin plate AB be fixed at one end, and at the other end B let it be fastened to a bar or arm BD perpendicular to DH, and to which it is fixed at the point D. The figure of the plate AB is that of the evolute of the given parabola MEC.

The equation of this evolute, being also that of the semicubical parabola, is $\frac{27}{16}px^2=y^3$.—Let $\frac{27}{16}p=P$; then $Px^2=y^3$, and in the focus $P=2y$. In this case $2x^2=y^2=\frac{1}{4}P^2$: hence $x^2=\frac{1}{8}P^2$, and $x=P\sqrt{\frac{1}{8}}=\frac{27}{16}p\sqrt{\frac{1}{8}}=$ the distance of the focus from the vertex A.—By assuming the value of x, the ordinates of the curve may be found; and hence it may be easily drawn.

The string of the pendulum must be of such a length that when one end is fixed at B, it may lie over the plate AB, and then hang perpendicular from it, so that the centre of the bob may be at E when at rest. Now, the verge KH being put into motion, the ball of the pendulum will begin to gyrate, and thereby conceive a centrifugal force which will carry it out from the axis to some point F, where it will circulate seconds or half seconds, according as the line AE is 9.8 inches, or 2¼ inches, and AB answerable to it.

One advantage possessed by a clock having a pendulum of this construction is, that the second hand moves in a regular and uniform manner, without being subject to those jerks or starts as in common clocks; and the pendulum is entirely silent.

Theory has pointed out several other pendulums, known by the names of *Elliptical*, *Horizontal*, *Rotulary*, &c. pendulums. These, however, have not as yet attained that degree of perfection as to supplant the common pendulum.

Observing that both the gridiron and mercurial pendulums are subject to many inconveniences and errors, Mr Kater has attempted to construct one possessing such properties in respect of cheapness and accuracy as he thinks might justly give it the preference to any other. As wood possesses a less degree of expansibility by means of heat than any other substance; on this account, if it could be rendered quite impervious to moisture, it would be the best of all substances for the rod of a pendulum; and as it also appears that zinc, above all other metals, possesses the greatest degree of expansibility by means of heat, he considered it the best substance which could be employed for a compensation. His next object was to institute a set of delicate experiments, in order to ascertain the precise degree of the expansibility of wood by the application of heat, and he discovered by the use of a pyrometer, that a rod of very dry, well seasoned white wood, four feet long, three-fourths of an inch broad, and one-fourth of an inch thick, when exposed in an oven to the temperature of 235°, had contracted. Being again put into the oven, where it was permitted to remain for a long time till it became a little discoloured, with a view to dissipate the whole of the moisture, it was placed in the pyrometer, and allowed to remain till it reached the temperature of the room, or 49°, when it was found to have contracted 0.0205 of an inch with 186° of Fahrenheit, from which we obtain by proportion 0.0049 of an inch for the expansion of one foot with 180° difference of temperature. Thus,

$$\frac{0.0205\times 180}{186}=\frac{0.0198}{4}=0.0049.$$

But for a general description of this pendulum, and a full account of the manner in which it is constructed, we must refer our readers to the inventor's own paper, Nichol. Jour. vol. xx. p. 214.

Besides the use of the pendulum in measuring time, it has also been suggested as a proper standard for measures of length. See MEASURE.

PENEA, a genus of plants belonging to the tetrandria class, and in the natural method ranking with those of which the order is doubtful. See BOTANY *Index*.

PENELOPE, in fabulous history, the daughter of Icarus, married Ulysses, by whom she had Telemachus. During the absence of Ulysses, who was gone to the siege of Troy, and who staid 20 years from his dominions, several princes charmed with Penelope's beauty, told her that Ulysses was dead, offered to marry her, and pressed her to declare in their favour. She promised compliance on condition they would give her time to finish a piece of tapestry she was weaving; but at the same time she undid in the night what she had done in the day, and by this artifice eluded their importunity till Ulysses's return.

PENELOPE, a genus of birds of the order of *gallinæ*. See ORNITHOLOGY *Index*.

PENESTICA, (Antonine), a town of the Helvetii, situated between the Lacus Lausonius and Salodurum; called *Petenisea* by Peutinger. Thought now to be *Biel* (Cluverius); the capital of a small territory in Swisserland.

PENEUS, (Strabo); a river running through the middle of Thessaly, from west to east, into the Sinus Thermaicus, between Olympus and Ossa, near Tempe of Thessaly, rising in Mount Pindus, (Ovid, Val. Flaccus).

PENETRALE, a sacred room or chapel in private houses, which was set apart for the worship of the household gods among the ancient Romans. In temples also there were *penetralia*, or apartments of distinguished sanctity, where the images of the gods were kept, and certain solemn ceremonies performed.

PENGUIN, or PINGUIN. See PENGUIN, ORNITHOLOGY *Index*.

PENICILLUS, among surgeons, is used for a tent to be put into wounds or ulcers.

PENIEL, or PENUEL, a city beyond Jordan, near the ford or brook Jabbok. This was the occasion of its name. Jacob, upon his return from Mesopotamia, (Gen. xxxii. 24, &c.) made a stop at the brook Jabbok: and very early the next morning, after he had sent all the people before, he remained alone, and behold an angel came, and wrestled with him till the day began to appear. Then the angel said to Jacob, Let me go, for the morning begins to appear. Jacob answered, I shall not let you go from me till you have given me your blessing. The angel blessed him then in the same place, which Jacob thence called Peniel, saying, I have seen God face to face, yet continue alive.

In following ages the Israelites built a city in this place, which was given to the tribe of Gad. Gideon, returning from the pursuit of the Midianites, overthrew the tower of Peniel, (Judges viii. 17.), and put all the inhabitants of the city to death, for having refused sustenance to him and his people, and having answered him in a very insulting manner. Jeroboam the son of Nebat rebuilt the city of Peniel, (1 Kings xii. 25.). Josephus says, that this prince there built himself a palace.

PENINNAH, the second wife of Elkanah, the father of Samuel. Peninnah had several children, (1 Sam. i. 2, 3, &c.), but Hannah, who afterwards was mother of Samuel, was for a great while barren: Peninnah, instead of giving the glory to God, the author of fruitfulness, was elevated with pride, and insulted her rival Hannah. But the Lord having visited Hannah, Peninnah was thereupon humbled: and some interpreters think, that God took away her children from her, or at least that she had no more after this time, according to the words of the song of Hannah, (1 Sam. ii. 5.), "The barren hath born seven, and she that hath many children is waxed feeble."

PENINSULA, in *Geography*, a portion or extent of land joining to the continent by a narrow neck or isthmus, the rest being encompassed with water.

PENIS, in *Anatomy*. See ANATOMY *Index*.

PENITENCE, is sometimes used for a state of repentance, and sometimes for the act of repenting. See REPENTANCE. It is also used for a discipline, or punishment atending repentance; more usually called *penance*. It also gives title to several religious orders, consisting either of converted debauchees, and reformed prostitutes, or of persons who devote themselves to the office of reclaiming them. Of this latter kind is the

Order of PENITENCE *of St Magdalen*, established about the year 1272 by one Bernard, a citizen of Marseilles, who devoted himself to the work of converting the courtezans of that city. Bernard was seconded by several others; who, forming a kind of society, were at length erected into a religious order by Pope Nicholas III. under the rule of St Augustine. F. Gesnay says, that they also made a religious order of the penitents, or women they converted, giving them the same rules and observances which they themselves kept.

Congregation of PENITENCE *of St Magdalen at Paris*, owed its rise to the preaching of F. Tisseran a Franciscan, who converted a vast number of courtezans about the year 1492. Louis duke of Orleans gave them his house for a monastery; or rather, as appears by their constitutions, Charles VIII. gave them the hotel called *Bochaigne*, whence they were removed to St George's chapel, in 1572. By virtue of a brief of Pope Alexander, Simon bishop of Paris, in 1497, drew up for them a body of statutes, and gave them the rule of St Augustine. It was necessary, before a woman could be admitted, that she had first committed the sin of the flesh. None were admitted who were above 35 years of age. Till the beginning of the last century, none but penitents were admitted; but since its reformation by Mary Alvequin, in 1616, none have been admitted but maids, who, however, still retain the ancient name penitents.

PENITENTS, an appellation given to certain fraternities of penitents distinguished by the different shape and colour of their habits. These are secular societies, who have their rules, statutes, and churches, and make public processions under their particular crosses or banners. Of these there are more than a hundred, the most considerable of which are as follow: the white penitents, of which there are several different sorts at Rome, the most ancient of which was constituted in 1264; the brethren of this fraternity every year give portions to a certain number of young girls, in order to their being married: their habit is a kind of white sackcloth, and on the shoulder is a circle, in the middle of which is a red and white cross. Black penitents, the most considerable of which are the brethren of mercy, instituted in 1488 by some Florentines, in order to assist criminals during their imprisonment, and at the time of their death: on the day of execution they walk in procession before them, singing the seven penitential psalms and the litanies; and after they are dead, they take them down from the gibbet and bury them; their habit is black sackcloth. There are others whose business it is to bury such persons as are found dead in the streets: these wear a death's head on one side of their habit. There are also blue, gray, red, green, and violet penitents; all of whom are remarkable for little else besides the different colours of their habits.

Mabillon tells us, that at Turin there are a set of penitents kept in pay to walk through the streets in procession, and cut their shoulders with whips, &c.

Penitents, or *Converts of the name of Jesus*, a congregation of religious at Seville in Spain, consisting of women who had led a licentious life, founded in 1550. This monastery is divided into three quarters: one for professed religious; another for novices; a third for those who are under correction. When these last give signs of a real repentance, they are removed into the quarter of the novices, where, if they do not behave themselves well, they are remanded to their correction. They observe the rule of St Augustine.

Penitents of Orvieto, are an order of nuns, instituted by Antony Simoncelli, a gentleman of Orvieto in Italy. The monastery he built was at first designed for the reception of poor girls, abandoned by their parents, and in danger of losing their virtue. In 1662 it was erected into a monastery, for the reception of such as, having abandoned themselves to impurity, were willing to take up, and consecrate themselves to God by solemn vows. Their rule is that of the Carmelites.

These religious have this in peculiar, that they undergo no noviciate. All required is, that they continue a few months in the monastery in a secular habit; after which they are admitted to the vows.

PENITENTIAL, an ecclesiastical book, retained among the Romanists; in which is prescribed what relates to the imposition of penance and the reconciliation of penitents. See PENANCE.

There are various penitentials, as the Roman penitential, that of the venerable Bede, that of Pope Gregory III. &c.

PENITENTIARY, in the ancient Christian church, a name given to certain presbyters or priests, appointed in every church to receive the private confessions of the people, in order to facilitate public discipline, by acquainting them what sins were to be expiated by public penance, and to appoint private penance for such private crimes as were not proper to be publicly censured.

PENITENTIARY, at the court of Rome, is an office in which are examined and delivered out the secret bulls, graces, or dispensations relating to cases of conscience, confessions, &c.

PENITENTIARY, is also an officer, in some cathedrals, vested with power from the bishop to absolve, in cases referred to him. The pope has at present his grand penitentiary, who is a cardinal and the chief of the other penitentiary priests established in the church of Rome, who consult him in all difficult cases. He presides in the penitentiary, dispatches dispensations, absolutions, &c. and has under him a regent and proctor.

PENITENTIARY, a prison or place of confinement for criminals, in which the prisoners are made to labour, and a system of discipline is employed for effecting their reformation. The building is so constructed that the overseer from a central station can observe the conduct of every individual. There is an establishment of this kind at Milbank, near London, but the building is not yet finished. It is intended for the reception of such criminals as have hitherto been transported to New South Wales, for a less period than during life.

PENMAN-MAWR, a mountain in Caernarvonshire, 1400 feet high. It hangs perpendicularly over the sea, at so vast a height, that few spectators are able to look down the dreadful steep. On the side which is next the sea, there is a road cut out of the side of the rock, about six or seven feet wide, which winds up a steep ascent.

PENN, WILLIAM, an eminent writer among the Quakers, and the planter and legislator of Pensylvania, was the son of Sir William Penn, and was born at London in 1644. In 1660, he was entered a gentleman of Christ-Church, in Oxford; but having before received an impression from the preaching of one Thomas Loe a Quaker, withdrew with some other students from the national worship, and held private meetings, where they preached and prayed amongst themselves. This giving great offence to the heads of the college, Mr Penn, though but 16 years of age, was fined for nonconformity; and continuing his religious exercises, was at length expelled the college. Upon his return home, he was on the same account, treated with great severity by his father, who at last turned him out of doors; but his resentment afterwards abating, he sent him to France in company with some persons of quality; where he continued a considerable time, and returned not only well skilled in the French language, but a polite and accomplished gentleman. About the year 1666, his father committed to his care a considerable estate in Ireland. Being found in one of the Quakers meetings in Cork, he, with many others, was thrown into prison; but on his writing to the earl of Orrery, was soon discharged. However, his father being informed he still adhered to his opinions, sent for him to England, and finding him inflexible to all his arguments, turned him out of doors a second time. About the year 1668, he became a public preacher among the Quakers; and that year was committed close prisoner to the Tower, where he wrote several treatises. Being discharged after seven months imprisonment, he went to Ireland, where he also preached amongst the Quakers. Returning to England, he was in 1670 committed to Newgate, for preaching in Gracechurch-street meeting-house, London; but being tried at the sessions-house of the Old Bailey, he was acquitted. In September the same year, his father died; and being perfectly reconciled to him, left him both his paternal blessing and a good estate. But his persecutions were not yet at an end; for in 1671 he was committed to Newgate for preaching at a meeting in Wheeler-street, London; and during his imprisonment, which continued six months, he also wrote several treatises. After his discharge, he went into Holland and Germany; and in the beginning of the year 1672, married and settled with his family at Rickmansworth in Hertfordshire. The same year he published several pieces; and particularly one against Reeve and Muggleton. In 1677, he again travelled into Holland and Germany in order to propagate his opinions; and had frequent conversations with the princess Elizabeth, daughter to the queen of Bohemia, and sister to the princess Sophia, mother to King George I. In 1681, King Charles II. in consideration of the services of Mr Penn's father, and several debts due to him from the crown at the time of his decease, granted Mr Penn and his heirs the province lying on the west side of the river Delaware in North America, which from thence obtained the name of *Pensylvania.* Upon this Mr Penn published a brief account of that province, with the king's patent; and proposing an easy purchase of lands, and good terms of settlement for such as were inclined to remove thither, many went over. These having made and improved their plantations to good advantage, the governor, in order to secure the planters from the native Indians, appointed commissioners to purchase the land he had received from the king of the native Indians, and concluded a peace with them. The city of Philadelphia was planned and built; and he himself drew up the fundamental constitutions of Pensylvania in 24 articles. In 1681, he was elected a member of the Royal Society; and the next year he embarked for Pensylvania, where he continued about two years, and returned to England in August 1684. Upon the accession of King James to the throne, he was taken into a great degree of favour with his majesty, which exposed him to the imputation of being a Papist; but from which he fully vindicated himself. However, upon the Revolution, he was examined before the council in 1688, and obliged to give security for his appearance on the first day of next term, which was afterwards continued. He was several times discharged and examined; and at length warrants being issued out against him, he was obliged to conceal himself for two or three years. Being at last permitted to appear before the king and council, he represented his innocence so effectually that he was acquitted. In August 1699, he, with his wife and family, embarked for Pensylvania; whence he returned in 1701, in order to vindicate his proprietary right, which had been attacked during his absence. Upon Queen Anne's accession to the crown, he was in great favour with her, and was often at court. But, in 1707, he was involved in a lawsuit with the executors of a person who had been formerly his steward; and, though many thought him aggrieved, the court of chancery did not think proper to relieve him; upon which account he was obliged to live within the rules of the Fleet for several months, till the matter in dispute was accommodated. He died in 1718.

At one period of his life, Penn lodged in a house in Norfolk-street in the Strand. In the entrance to it he had a peeping-hole, through which he could see any person that came to him. A creditor one day sent in his name, and having been made to wait more than a reasonable time, he knocked for the servant, whom he asked, "Will not thy master see me?" "Friend (answered the servant) he has seen thee, but he does not like thee."

Mr Penn's friendly and pacific manner of treating the Indians produced in them an extraordinary love for him and his people; so that they have maintained a perfect amity with the English in Pensylvania ever since. He was the greatest bulwark of the Quakers; in whose defence he wrote numberless pieces. Besides the above works, he wrote a great number of others; the most esteemed of which are, 1. His Primitive Christianity revived. 2. His defence of a paper, intitled *Gospel Truths, against the Exceptions of the Bishop of Cork*. 3. His Persuasive to Moderation. 4. His Good Advice to the Church of England, Roman Catholic, and Protestant Dissenter. 5. The Sandy Foundation shaken. 6. No Cross, no Crown. 7. The great case of Liberty of Conscience debated. 8. The Christian Quaker and his Testimony stated and vindicated. 9. A Discourse of the general Rule of Faith and Practice, and Judge of Controversy. 10. England's Present Interest considered. 11. An Address to Protestants. 12. His Reflections and Maxims. 13. His Advice to his Children. 14. His Rise and Progress of the People called *Quakers*. 15. A Treatise on Oaths. Most of these have passed several editions, some of them many. The letters between William Penn and Dr Tillotson, and William Penn and William Popple, Esq. together with Penn's letters to the princess Elizabeth of the Rhine, and the countess of Hornes, as also one to his wife on his going to Pensylvania, are inserted in his works, which were first collected and published in 2 vols folio; and the parts since selected and abridged into 1 vol. folio, are very much and deservedly admired for the good sense they contain.

PENNANT, Thomas, Esq. a celebrated naturalist, was born in Flintshire, about the year 1726. His family had their residence in that country for several hundred years; and he informs us himself, that he acquired the rudiments of his education at Wrexham, from whence he was sent to Fulham. Not long after this he went to the university of Oxford, where his progress in classical knowledge was very considerable; after which he turned his attention to the study of jurisprudence; but it is no where said that he ever followed the law as a profession

We are informed that his taste for natural history, for his knowledge of which he afterwards became so conspicuous, was first excited by the perusal of Willoughby's Ornithology, a copy of which had been sent him in a present. He began his travels at home, which was certainly the most proper step, to acquire a knowledge of the manners, curiosities, and productions of his native country, before he attempted to delineate those of any other nation. He then visited the continent, where he acquired additional knowledge respecting his most favourite studies, and became acquainted with some of the most celebrated literary characters which that period produced. When he returned home he married and had two children; but he was 37 years of age before he gained possession of the family estate, after which he took up his residence at Downing.

On the death of his wife he set out again for the continent, where he became acquainted with Voltaire, Buffon, Pallas, and other eminent characters. Being an author as early as the year 1750 (then only 24 years of age), he had acquired a considerable degree of reputation in that capacity, by the time he became acquainted with the forementioned philosophers. His reputation as a naturalist was established by his British Zoology in four vols. 4to. and still farther increased by his epistolary correspondence with so great a man as Linnæus. He undertook a tour to Cornwall at an early period of life, and also felt an irresistible propensity to survey the works of nature in the northern parts of the kingdom. For this purpose he set out for Scotland in 1771, and published an amusing account of his tour in three vols. 4to, which was destined to receive such a share of public favour as to pass through several editions. His Welch tour was published in 1778, and his journey from Chester to London in 1782, in one volume 4to. About 1784 came out his Arctic Zoology, a work which was very much esteemed, both in his own, and in many other countries. He also gave the world a natural history of the parishes of Holywell and Downing, within the latter of which he had resided for more than 50 years. Not long before his death appeared his View of Hindostan, in two vols. 4to, to undertake which it seems he had solicitations from private friends, as well as the wishes of persons entirely unknown to him, which were expressed in the public prints. This was unquestionably a very bold attempt in a man who was turned of 70, a period at which the faculties of the mind must certainly be impaired, especially when exerted with vigour for such a number of years before. Notwithstanding his great age, however, the work is executed in an able manner, bearing a strong resemblance to the introduction of his Arctic Zoology.

He also published a letter on the earthquake which was felt at Downing in Flintshire, in the year 1753; another which was inserted in the Philosophical Transactions in 1756; his Synopsis of Quadrupeds in 1771; a pamphlet on the militia; a paper on the turkey, and a miscellaneous volume.

Almost every species of literary honour was conferred upon him; for he was complimented with the degree of LL. D. by the university in which he was educated; he was also fellow of the Royal Society, and a member of the Society of Antiquaries; a fellow of the Royal Society of Upsal in Sweden; a member of the American Philosophical Society; an honorary member of the Anglo-Linnæan Society, &c. &c.

He was enabled to exhibit the greatest hospitality at his table, in consequence of the ample fortune which was left him at his father's decease, and he gave the profits arising from the sale of several publications to charitable endowments. By his generous patronage a number of engravers met with great encouragement, and he contributed not a little to the promotion of the fine arts. About the age of 50 he married for the second time, a Miss Mostyn, sister of his neighbour, the late Sir Roger Mostyn of Flintshire. The concluding part of his life was cheerful, and it may be affirmed that he scarcely felt the advances of old age. He died at his seat at Downing in 1798, and in the 72d year of his age.

He inherited from nature a strong and vigorous constitution; his countenance was open and intelligent; his disposition active and cheerful; and his vivacity, both in writing and conversation, made him perpetually entertaining. His heart was kind and benevolent, and in the relations of domestic life his conduct was highly worthy of imitation. The distresses in which his poor neighbours were at any time involved gave him unfeigned uneasiness, and he endeavoured to relieve them by every means in his power. He was possessed of candour, and free from common prejudices, a truth fully evinced in all his publications. The people of Scotland were proud to confess, that he was the first English traveller who had fairly represented their country in its favourable, as well as in its less pleasing appearances. His style is lively, and fitted to convey the ideas which he intended to express, but it is not always correct. In zoology his arrangement is judicious, and his descriptions characteristic. If we discover several traces of vanity in those works which he published near the close of life, it ought to be remembered that it is the vanity of an old man, which is seldom disagreeable; and it is also the vanity of one who in the meridian of life gave the world such fruits of his labours as will be justly admired in all succeeding ages, while a taste for polite and valuable literature is cherished among men.

PENNATULA, or SEA-PEN, a genus of animals belonging to the order zoophyta. See HELMINTHOLOGY *Index*.

PENNI, GIOVANNI FRANCISCO, born at Florence in 1488, was the disciple of Raphael, who observing his genius and integrity, intrusted his domestic concerns entirely to his management; by which means he got the appellation of *il fatore*, or the "steward," which he retained ever after. The genius of Penni was universal; but his greatest pleasure was in painting landscapes and buildings; he was an excellent designer, and coloured extremely well in oil, distemper, and fresco. He painted portraits in an exquisite style; and had such happy natural talents, that Raphael left him heir to his fortune in partnership with Julio Romano his fellow disciple. After Raphael's death, Penni painted many pictures at Rome, particularly in the palace of Chigi, so exactly in the style of his master, that they might not undeservedly have been imputed to him: he finished, in conjunction with Julio and Pierino del Vaga, the celebrated designs of the battles of Constantine, and others, which Raphael had left imperfect; but differing with them about a copy of the transfiguration, which the pope intended for the king of France, they separated. Penni went to Naples; but the air of that country disagreeing with his constitution, he died soon after in 1528. He had a brother called *Lucca Penni*; who worked at Genoa and other parts of Italy in conjunction with Pierino del Vaga, who married his sister; he went thence to England, where he worked for Henry VIII. and for several merchants; was employed by Francis I. at Fontainbleau; but at last quitted the pencil, and devoted himself to engraving.

PENNY, or PENY, in commerce, an ancient English coin, which had formerly considerable currency; but is now generally dwindled into an imaginary money, or money of account. Camden derives the word from the Latin *pecunia*, "money."

The ancient English penny, penig, or pening, was the first silver coin struck in England; nay, and the only one current among our Saxon ancestors: as is agreed by Camden, Spelman, Dr Hicks, &c.

The penny was equal in weight to our three-pence; five of them made one shilling, or scilling Saxon; 30 a mark or mancuse, equal to 7*s*. 6*d*.

Till the time of King Edw. I. the penny was struck with a cross, so deeply indented in it, that it might be easily broke, and parted, on occasion, into two parts, thence called *half-pennies*; or into four, thence called *fourthings* or *farthings*.—But that prince coined it without indenture, in lieu of which, he first struck round halfpence and farthings.

He also reduced the weight of the penny to a standard; ordering that it should weigh 32 grains of wheat, taken out of the middle of the ear.—This penny was called the *penny sterling*.—Twenty of these pence were to weigh an ounce; whence the penny became a weight as well as a coin. See STERLING and *PENNY-Weight*.

The penny sterling was long disused as a coin; and was scarce known, but as a money of account, containing the twelfth part of a shilling; but of late years it has been introduced into the British current coin.

PENNY, in ancient statutes, &c. is used for all silver money. And hence the *ward-penny*, *aver-penny*, *hundred-penny*, *tithing-penny*, and *brothal-penny*.

PENNY-Weight, a Troy weight, containing twenty-four grains; each grain weighing a grain of wheat gathered out of the middle of the ear, well dried. The name took its rise hence, that this was anciently the weight of one of our ancient silver pennies. See PENNY.

Twenty of these penny-weights make an ounce Troy.

PENRITH, an ancient town of the county of Cumberland in England, seated under a hill called *Penrith-Fell*, near the rivers Eamont and Lowther. It is a great thoroughfare for travellers; but has little other trade, excepting tanning, and a small manufacture of checks. Formerly it had a castle, but it is now in ruins. In the churchyard is a monument of great antiquity, consisting of two stone pillars 11 feet 6 inches high, and 5 in circumference in the lower part, which is rounded; the upper is square, and tapers to a point; in the square part is some fretwork, and the relievo of a cross; and on the interior side of one is the faint representation of some animal. Both these stones are mortised at their lower part into a round one: they are about 15 feet asunder, and the space between them is inclosed on each side with two very large but thin semicircular stones; so that there is left between pillar and pillar a walk of two feet in breadth. Two of these lesser stones are plain, the others have certain figures, at present scarcely intelligible. Not far from these pillars is another called the *giant's thumb*, five feet eight inches high, with an expanded head, perforated on both sides; from the middle the stone rises again into a lesser head, rounded at top; but no part has a tendency to the figure of a cross, being in no part mutilated. The pillars are said to have been set up in memory of Sir Owen Caesarius, a famous warrior.

rior buried here, who killed so many wild bears, which much infested this county, that the figures of bears, cut out on stone, on each side of his grave, were set there in remembrance of the execution he made among those beasts; and it is likewise said his body extended from one pillar to the other. In the market-place there is a town-house of wood, beautified with bears climbing up a ragged staff. There is a memorandum on the north side of the vestry without, that, in 1598, 2266 persons died here of the plague. There is a charity school in this place for 20 boys, and another for 30 girls, maintained by 55l. a-year, by the sacrament money and parish-stock. In 1715 the Scotch Highlanders entered this town, and quartered in it for a night, in their way to Preston, without doing much harm; but in the last rebellion, in 1745, they were, it is said, very rapacious and cruel. Its handsome spacious church has been lately rebuilt, and the roof supported by pillars, whose shafts are of one entire reddish stone, dug out of a neighbouring quarry. On the east part of the parish, upon the north bank of the river Eamont, there are two caves or grottoes, dug out of the solid rock, and sufficient to contain 100 men. The passage to them is very narrow dangerous; and it is possible that its perilous access may have given it the name of *Isis Parlis;* though the vulgar tell strange stories of one Isis, a giant, who lived there in former times, and, like Cacus of old, used to seize men and cattle, and draw them into his den to devour them. But it is highly probable that these subterraneous chambers were made for a secure retreat in time of sudden danger; and the iron gates, which were taken away not long ago, seem to confirm that supposition. The population in 1811 was 4328. W. Long. 4. 43. N. Lat. 54. 35.

PENROSE, Thomas, was the son of the reverend Mr Penrose, rector of Newbury, Berks, a man of high character and abilities, descended from an ancient Cornish family, beloved and respected by all who knew him. Mr Penrose, jun. being intended for the church, pursued his studies with success, at Christ-church, Oxon, until the summer of 1762, when his eager turn to the naval and military line overpowering his attachment to his real interest, he left his college, and embarked in the unfortunate expedition against Nova Colonia, in South America, under the command of Captain Macnamara. The issue was fatal. The Clive (the largest vessel) was burnt; and though the Ambuscade escaped (on board of which Mr Penrose, acting as lieutenant of marines, was wounded), yet the hardships which he afterwards sustained in a prize sloop, in which he was stationed, utterly ruined his constitution. Returning to England with ample testimonials of his gallantry and good behaviour, he finished, at Hereford College, Oxon, his course of studies; and having taken orders, accepted the curacy of Newbury, the income of which, by the voluntary subscription of the inhabitants, was considerably augmented. After he had continued in that station about nine years, it seemed as if the clouds of disappointment, which had hitherto overshadowed his prospects, and tinctured his poetical essays with gloom, were clearing away; for he was then presented by a friend, who knew his worth and honoured his abilities, to a living worth near 500l. per annum. It came, however, too late; for the state of Mr Penrose's health was now such as left little hope, except in the assistance of the waters of Bristol. Thither he went; and there he died in 1779, aged 36 years. In 1768 he married Miss Mary Slocock of Newbury, by whom he had one child, Thomas, who was educated at Winton College.

Mr Penrose was respected for his extensive erudition, admired for his eloquence, and equally beloved and esteemed for his social qualities. By the poor, towards whom he was liberal to his utmost ability, he was venerated to the highest degree. In oratory and composition his talents were great. His pencil was ready as his pen, and on subjects of humour had uncommon merit. To his poetical abilities the public, by their reception of his Flights of Fancy, &c. have given a favourable testimony.

PENRYN, a town of Cornwall, in England, seated on a hill at the entrance of Falmouth-haven by Pendendis castle. The inhabitants in 1811 were 2713, and the streets are broad and well paved. There are so many gardens and orchards in it, that it resembles very much a town in a wood. It is well watered with rivulets, and has an arm of the sea on each side of it, with a good custom-house and quay, and other neat buildings. It drives a considerable trade in pilchards, and in the Newfoundland fishery. It was anciently governed by a portreeve; but James I. made it a corporation, consisting of a mayor, 11 aldermen, 12 common-councilmen, with a recorder, steward, &c. an office of record every three weeks, with a prison, and power to try felons in their jurisdiction. And he granted that the mayor and two aldermen should be justices of the peace, and that they should have a guildhall. There was once a monastery in this place, which was a cell to Kirton; and there are still to be seen a tower, and part of the garden walls, the ruins of a collegiate church. It has neither church nor chapel, but belongs to the parish of Gluvias, a quarter of a mile off. It has sent members to parliament ever since the first year of Queen Mary; and James II. granted it a new charter, whereby their election was vested in the magistracy only; but it was never made use of, all the inhabitants that pay scot and lot, who are not much above 100, being the electors. Mr Rymer gives a very remarkable account how Penryn was once saved by a company of strolling players. He says, that towards the latter end of the 16th century the Spaniards were landing to burn the town just as the players were setting Samson upon the Philistines; which performance was accompanied with such drumming and shouting, that the Spaniards thought some ambush was laid for them, and scampered back to their ships. Queen Elizabeth founded a free-school in this place. W. Long. 4. 58. N. Lat. 50. 23.

PENSACOLA, a town in North America, situated upon a bay of the same name in the gulf of Mexico. The bay is about 30 miles long and five broad, except at the entrance, where it does not much exceed a mile; and is defended by the fort of Barancas, situated about three miles from its mouth. The town, which is situated about ten miles from the mouth of the bay, is of importance chiefly for its harbour, which is the best in the gulf of Mexico.

The year 1781, so eventful to Britain in many respects, was also remarkable for the reduction of Pensacola by the Spaniards under Don Bernardo Galvez. Great preparations for this expedition had been making at the Havannah; but a dreadful hurricane obliged it to put back to repair; but as soon as the fleet was again judged capable of putting to sea, an embarkation was made of near 8000 men, with Don Bernardo at their head, together with five ships of the line, who arrived at Pensacola on the 9th of March 1781. This force was soon augmented by ten ships of the line and six frigates; while General Campbell, the British governor, could oppose such a formidable armament with few more than 1000 men, consisting of some regulars and seamen, with the inhabitants. The entrance of the harbour, which was the principal object of defence, was guarded by two small armed vessels, but they were insufficient to second the batteries that had been erected for its protection; and these, without the assistance of some ships of force, were incapable of resisting a vigorous attack. Notwithstanding this prodigious odds, however, the Spaniards met with the most determined opposition. Every inch of ground was disputed with the greatest resolution. The harbour was not forced without the greatest difficulty, nor could the vessels be taken that defended it; the companies belonging to them, after setting them on fire, retired on shore.

The Spaniards, now in possession of the harbour, invested the place in form, and made their approaches in a cautious and regular manner; while, on the other hand, the besieged were no less active and vigilant in their own defence. Sallies were made occasionally with great success, at the same time that an uninterrupted fire was kept up in such a manner as not only greatly to annoy, but even to strike the besiegers with astonishment. This incensed the Spanish general the more, as he knew that the garrison could expect no relief, and therefore that all their efforts could only prolong the date of their surrender. The resistance was the more mortifying, as he was perfectly conscious of the bravery of his troops; and he had artillery fit, as his officers expressed themselves, "to be employed against Gibraltar." With all these advantages, however, so resolute was the defence of the garrison, that after the siege had continued for two months, very little hope could be entertained of its speedy termination. As they despaired therefore of making any effectual impression by means of their cannon, they erected a battery of mortars, with which they bombarded a redoubt that commanded the main avenue to the place; and in this they were favoured by an unexpected accident. On the 8th of May a shell burst open the door of the powder magazine under the redoubt, by which it was blown up, with the loss of near 100 men killed and wounded. Fortunately for the garrison, however, two flank-works still remained entire, from both which so heavy a fire was kept up, that though an assault was immediately given, the assailants were repulsed with great slaughter. This afforded leisure to the garrison to carry off the wounded men, with some of the artillery, and to spike up the rest. As the enemy, however, soon recovered themselves, and prepared for a general storm, it was thought proper to abandon the flank-works, and retire into the body of the place. The possession of these outworks, however, gave the enemy such advantages, that the place was no longer tenable. Their situation, on a rising ground, enabled them to command the battery opposite to their chief approach with small arms, and to single out the men at their guns. A capitulation therefore became absolutely necessary, which was obtained on honourable terms. The town, with the whole province of West Florida, was confirmed to the Spaniards by the treaty of 1783, and continued in their possession till the 24th May 1818, when it was taken after a trifling resistance by the American general Jackson, on pretence that the Spaniards, though then at peace with the United States, had aided the Seminole Indians in their hostilities. By a treaty published in May 1819, this town with the whole of East and West Florida was ceded to the United States, but the treaty has not yet been ratified by the king of Spain. (June 1819.) W. Long. 87. 12. N. Lat. 30. 28.

PENSANCE, a town of Cornwall, in England, at the bottom of Mountsbay, about ten miles from the Land's End. It was burnt in 1595 by the Spaniards, who, with four galleys, surprised this part of the coast, and set fire to several villages and farms: but it was soon after rebuilt, made one of the coinage towns, and has now a considerable trade. It lies in the parish of Madern, noted for its restorative spring, very effectual in the cure of lameness as well as the cholic, &c. It is well built, and has many ships belonging to it. The population in 1801 exceeded 3000 souls. The shore abounds with lead, tin, and copper ore; the veins appear on the utmost extent of land at low-water mark.

PENSILES HORTI, *Hanging Gardens*, in antiquity. See BABYLON, N° 5.

PENSILVANIA, one of the United States of North America, had its name from the famous Quaker William Penn, son of Sir William, commander of the English fleet in Oliver Cromwell's time, and in the beginning of Charles II.'s reign, who obtained a grant of it in the year 1679. It is bounded on the east by Delaware bay and river; on the north by the state of New York; on the south by Maryland and Virginia; and on the west by Ohio. Its extent from north to south is about 153 miles; its breadth is about 273; its area is 24,500 square miles.

New York, the Jerseys, and Pensilvania, were discovered, with the rest of the continent of North America, in the reign of Henry VII. by Sebastian Cabot, for the crown of England; but Sir Walter Raleigh was the first adventurer that attempted to plant colonies on these shores, in the reign of Queen Elizabeth; and, in honour of that princess, gave all the eastern coast of North America the name of *Virginia*. Mr Hudson, an Englishman, sailing to that part of the coast which lies between Virginia and New England, in the beginning of the reign of James I. and being about to make a settlement at the mouth of Hudson's river, the Dutch gave him a sum of money to dispose of his interest in this country to them. In the year 1608 they began to plant it; and, by virtue of this purchase, laid claim to all those countries which are now denominated *New York*, *New Jersey*, and *Pensilvania*; but there remaining some part of this coast which was not planted by the Hollanders, the Swedes sent a fleet of ships thither, and took possession of it for that crown; but the Dutch having a superior force in the neighbourhood, compelled the Swedes to submit to their dominion, allowing them, however, to enjoy the plantations they had settled. The English not admitting that either the Dutch or Swedes had any right to countries first discovered and planted by a subject of England, and part of them at that time possessed by the subjects of Great Britain, under charter from Queen Elizabeth and King James I.; King Charles II. during the first Dutch war in 1664, granted the countries of New York, the Jerseys, and Pensilvania, of which the Dutch had usurped the possession, to his brother James duke of York; and Sir Robert Carr being sent over with a squadron of men of war and land forces, and summoning the Dutch governor of the city of New Amsterdam, now New York, to surrender, he thought fit to obey the summons, and yield that capital to the English: the rest of the places in the possession of the Dutch and Swedes followed his example; and these countries were confirmed to the English by the Dutch at the next treaty of peace between the two nations. The duke of York afterwards parcelled them out to under proprietors; selling, in particular, to William Penn the elder, in 1683, the town of Newcastle, *alias* Delaware, and a district of 12 miles round the same; to whom, his heirs, and assigns, by another deed of the same date, he made over all that tract of land from 12 miles south of Newcastle to the Whore-hills, otherwise called *Cape Henlopen*, now divided into the two counties of Kent and Sussex, which, with Newcastle district, are commonly known by the name of the *Three Lower Counties upon Delaware River*. All the rest of the under proprietors, some time after, surrendered their charters to the crown; whereby New York and the Jerseys became royal governments; but Penn retained that part of the country which had been sold to him by the duke of York, together with what had been granted to him before in 1680-1, which now constitutes the province of Pensilvania. As soon as Penn had got his patent, he began to plant the country. Those who went over from England were generally Dissenters and Quakers, whose religion is established by law here, but with a toleration of all other Protestant sects. The Dutch and Swedes, who were settled here before Mr Penn became proprietor, choosing still to reside in this country, as they did in New York and the Jerseys, obtained the same privileges as the rest of his majesty's subjects; and their descendants are now in a manner the same people with the English, speaking their language, and being governed by their laws and customs. Mr Penn, however, not satisfied with the title granted him by King Charles II. and his brother, bought the lands also of the Indians for a valuable consideration, or what they esteemed such (though 20 miles were purchased, at first, for less than an acre about Philadelphia would pay now), paying them in cloth, tools, and utensils, to their entire satisfaction: for they had not hands to cultivate the hundredth part of their lands, and if they could have raised a product, there was nobody to buy: the purchase, therefore, was all clear gain to them; and, by the coming of the English, their paltry trade became so profitable, that they soon found their condition much altered for the better; and are now as well clothed and fed as the European peasantry in many places.

The air in Pensilvania is sweet and clear. The fall, or autumn, begins about the 20th of October, and lasts till the middle of December, when the winter sets in, which continues till March, and is sometimes extremely cold and severe; but the air is then generally dry and healthy. The river Delaware, though very broad, is often frozen over. From March to June, that is, in the spring, the weather is more inconstant than in the other seasons. In the months of July, August, and September, the heats would be almost intolerable, if they were not mitigated by frequent cool breezes. The wind during the summer is generally south-west; but in the winter blows for the most part from the north-west over the snowy frozen mountains and lakes of Canada, which occasions the excessive cold during that season. On the whole, the climate of this state differs not materially from that of Connecticut, except that on the west side of the mountains the weather is much more regular. The hot southwardly winds get chilled by passing over the long chain of Allegany mountains. The mean annual temperature of Philadelphia, according to Humboldt, is 54.8, of winter 33.8, of spring 53, of summer 75.2, and of autumn 56.1.

This is upon the whole one of the healthiest states in the Union. In 1793, and 1797, Philadelphia was visited by the yellow fever; but since the latter period it has been entirely exempted from this disease. Among the people called Quakers, who are the oldest settlers, there are instances of longevity, occasioned by their living in the old cultivated countries, and the temperance imposed on them by their religion. There are fewer long-lived people among the Germans than among other nations, occasioned by their excess of labour and low diet. They live chiefly upon vegetables and watery food, that affords too little nourishment to repair the waste of their strength by hard labour. The most general diseases are rheumatism and pleurisy. The first is very common in the interior, and often becomes chronic. The goitre is said to prevail in a slight degree at Pittsburg.

As to the face of this country, towards the coast, like the adjacent colonies, it is flat, but rises gradually to the Apalachian mountains on the west. Nearly one-third of this state may be called mountainous; particularly the counties of Bedford, Huntingdon, Cumberland, part of Franklin, Dauphin, and part of Bucks and Northampton, through which pass, under various names, the numerous ridges and spurs, which collectively form what are called *the great range of Allegany mountains*. There is a remarkable difference between the country on the east and west side of the range of mountains we have just been describing. Between these mountains and the lower falls of the rivers which run into the Atlantic, not only in this, but in all the southern states, are several ranges of stones, sand, earths, and minerals, which lie in the utmost confusion. Beds of stone, of vast extent, particularly of limestone, have their several layers broken in pieces, and the fragments thrown confusedly in every direction. Between these lower falls and the ocean is a very extensive collection of sand, clay, mud, and shells, partly thrown up by the waves of the sea, partly brought down by floods from the upper county, and partly produced by the decay of vegetable substances. The country west of the Allegany mountains, in these respects, is totally different. It is very irregular, broken, and variegated, but there are no mountains; and when viewed from the most western ridge of the Allegany, it appears to be a vast extended plain. All the various strata of stone appear to have lain undisturbed in the situation wherein they were first formed. The layers of clay, sand, and coal, are nearly horizontal. Scarcely a single instance is to be found to the contrary. Every appearance, in short, tends to confirm the opinion, that the original crust, in which the stone was formed, has never been broken up on the west side of the mountains, as it evidently has been eastward of them.

The chief rivers are three, Delaware, Susquehanna, and Schuylkil. The Delaware, rising in the state of New York, takes its course southward; and after dividing this province from that of New Jersey, falls into the Atlantic ocean between the promontories or capes May and Henlopen, forming at its mouth a large bay, called from the river *Delaware Bay*. This river is navigable above 200 miles. Ships of the line can ascend to Philadelphia. The Susquehanna rises also in the state of New York, and running south through the middle of the province, falls into the bay of Chesapeake. It is not navigable near the sea, owing to rocks. The Schuylkil has its source within the state, and runs south, till at length, turning to the eastward, it falls into the river Delaware 6 miles below the city of Philadelphia. It navigable for boats 100 miles. The Allegany river traverses the north-western parts of the state, and joining the Monongahela at Pittsburg, forms the Ohio. All these rivers admit of boat navigation.

The principal mineral productions are, iron ore, which is found in great quantities in several counties, and of various kinds; copper ore, said to be found, but is not wrought; lead ore, yielding 20 per cent. of metal; black lead; slate of a good quality; freestone and limestone; marble, black, white, and variegated; coal of an excellent quality on the Susquehanna, Allegany, Monongahela, Leheigh, and Schuylkil rivers. There are also several mineral springs, some of which are in high estimation for their medicinal virtues. The salt springs of Conemaugh produce a hundred bushels of salt per day. In Venargo county an oil spring rises from the bed of the Allegany river, which yields a gallon in the course of an hour or two.

Pensilvania abounds in excellent wood, oak, chesnut, beech, elm, black walnut, bass wood, butternut, locust and magnolia. The latter is not found farther north than this state. The sugar maple is abundant, and in the hilly parts near Lake Erie is found in the proportion of six or eight trees to an acre. About one million of pounds of sugar were made from the maple in this state in 1810.

The wild animals are now rare in this state, having retired as cultivation advanced. Deer are still common in the uncultivated districts; and the brown bear, wolf, wild cat, and fox, are met with occasionally. The musk-rat is found in marshy places. The beaver and otter are nearly extinct: the cougouar is rarely seen. The wild turkey, with some species of pheasants, grouse, and pigeons, are found. The rivers and creeks abound with salmon, trout, shad, carp, eels, rockfish, &c. The caterpillar sometimes does much injury to vegetation. The grass or meadow-worm is another destructive insect which occasionally visits the country. The musquito is sometimes troublesome in low valleys, but never in elevated parts. Mr Cobbet states, as the result of his own observations and experiments, that even low situations may be kept free of this insect, if care is taken to remove all filth and putrid or decayed matter. The beetle, known by the name of tumblebug, is in many parts destructive to the Indian corn. The other kinds of grain are liable to be injured by a species of grashopper, which appears at an interval of 17 or 18 years.

The population of this state at different periods was as follows:

		Slaves included.	Free Blacks.
1749	220,000		
1774	350,000		
1790	434,375	3737	6587
1800	602,549	1706	14,564
1810	810,091	795	22,492

As it is believed that the rate of increase has not diminished, the number will probably be about 1,050,000 at present (1819), which gives about 42 inhabitants to each square mile. Pensilvania is the third state in point of population; Virginia being the first, and New York the second. The chief town is Philadelphia, which is estimated to contain 120,000 inhabitants.

The constitution of this state is said to have been drawn up by the late Sir William Jones. The legislative power is vested in a general assembly, consisting of a senate and house of representatives. The senators are elected for four years, the representatives for one, by the free citizens of 21 years of age, who have resided two years within the state and paid taxes. A fourth part of the senate is renewed annually. Senators must be 25 years of age, and must have resided four years in the state; representatives must be 21 years of age, and must have resided three years in the state. The number of representatives cannot be less than 60, nor more than 100. The governor is elected by the citizens for three years, and is commander-in-chief of the army and navy, except when called into the service of the United States. Persons holding public offices are only required to acknowledge the being of a God, and a future state of rewards and punishments. The judges are appointed by the governor, and may be impeached or removed by him, on the address of two-thirds of both houses. Pensilvania was the first state that carried into execution the ideas of philosophical writers on the subject of criminal law. Only the two crimes of murder and arson are punished with death; inferior crimes with hard labour. The laws are mild, and the grand object of making the punishment contribute to the reformation of the individual, is steadily kept in view. The prison of Philadelphia is the best conducted institution of the kind in the world; and its system of discipline has served as a model to the most enlightened states in Europe.

The militia of this state in 1812 consisted of 99,414 men, of whom whom 2005 were artillery and cavalry. There are no taxes for the general government. Those for the expences of the state government are very small. The most entire religious freedom exists here. Indeed Pensilvania was the first among the North American states to set the example of complete liberty of conscience. In 1802 there were 36 congregations of Presbyterians, 84 of German Calvinists, 84 of German Lutherans, 54 of Quakers, 26 of Episcopalians, 15 of Baptists, 11 of Roman Catholics, 8 of Scotch Presbyterians, 8 of Moravians; of free Quakers, Covenanters, Universalists, each 1, and the Jews had two synagogues. In 1817 the number of Baptist churches was 60.

There are many charitable and benevolent institutions in this state. Those in the capital are very numerous, and remarkably well conducted. Schools are also numerous, and it has been resolved to establish an academy in each county. The university of Pensilvania is in a flourishing condition, and has received various grants from the legislature. There are six professors in the medical school, four in that of philosophy and languages, and five in that of natural science. The number of students in 1811 was 500. The professors have each a salary of 500 dollars. Dickinson College has professors of logic, metaphysics, mathematics, the learned languages, modern languages, philosophy and chemistry, with a considerable library. Franklin college, established in 1783, by some Germans, has not flourished. Washington college, near Pittsburg, was established in 1802.

The eastern districts of Pensilvania are among the most improved parts of North America. The business of farming is carried on with spirit and skill, the soil being good, and many of the farmers wealthy and interprising. Besides the usual kinds of manure applied to the ground, gypsum is used for this purpose in great quantities, and is reckoned extremely beneficial; the rotation of crops is well understood; artificial grasses have been introduced; and excellent crops of hay are raised from meadow land. Besides the usual species of corn, buck wheat is much cultivated. Hemp and flax succeed well. Vines have been found to thrive, and all the fruits of France are produced here. The breed of horses and black cattle is among the best in the United States. The common and Merino sheep thrive and have multiplied amazingly. The number of sheep in 1810 was 618,280, of black cattle 612,990, of horses 225,640. The value of the land increases as we approach the capital. The average value per acre was estimated by a committee in 1815, to be for Philadelphia county 120 dollars; for the other counties, from 52 down to $1\frac{1}{8}$ dollars; and for the whole state, was about 29 dollars. But this last estimate does not include the unoccupied lands. The total value of houses and lands in this state was found, from valuations made in 1799, to be 102,145,900, and from valuations in 1815, 346,633,889 dollars; having increased about 240 per cent in 15 years.

The manufactures of this state, according to the returns for 1810, were much greater than those of any other state in the Union. The most considerable are those of iron, flax, hemp, wool, cotton, leather, hats, paper, spirits, maple sugar. Many of the manufactures are domestic, and of course upon a small scale, but there are also extensive establishments in some of them. During the late war with Britain, the manufactures increased with extraordinary rapidity, but the influx of foreign goods since the peace has caused many of them to be abandoned, and depressed those that still exist. Pittsburg, in the western part of this state, is the most considerable manufacturing town in the United States. It is situated on a navigable river, in a healthy situation, and its neighbourhood abounds with wood, coal, lime, and iron. The manufactures of this town in 1814 were estimated at 2,000,000 dollars. The whole amount of manufactures in this state in 1810 was estimated, from the returns of the marshal, at 33,691,111 dollars, exclusive of what were considered doubtful articles.

Pensilvania, though it has but one considerable port (Philadelphia) carries on a very extensive commerce. The whole exports in 1817 amounted to 8,735,592 dollars, of which 5,538,003 consisted of domestic produce, and 3,197,589 of foreign. The domestic articles of export consist chiefly of wheat and flour, beef and pork, flax seed, iron utensils, lumber, soap and candles; the imports, of British manufactures, wine, gin, rum, sugar, teas, nankeens, and silk. There were nine banks in the state in 1816, whose capitals together amounted to 10,534,130 dollars; the deposits including those due to other banks, to 8,449,474 dollars; and the notes discounted to 13,329,091 dollars.

There are three handsome bridges over the Schuylkil in this state. One of these consists of a single wooden arch of 343 feet span, and 42 feet in breadth. The Leheigh chain bridge is 475 feet long, in two whole, and two half spans. The wire bridge near Philadelphia is 400 feet long. The whole weight is only 4700 pounds. There are many other bridges deserving of notice, though generally of wood: one at Columbia, over the Susquehanna, is above a mile in length; another at Harrisburgh, about three fourths of a mile. There are at other places steam ferry boats, for the conveyance of passengers across the rivers. There are also a considerable number of steam passage boats which *ply on the* Delaware.

It was proposed, so far back as 1790, to extend the water communication from Philadelphia to Lake Erie, a distance of 561 miles, by joining the Susquehanna and the Delaware by a canal to extend from the Swetara to the Schuylkil. Some progress has been made in this undertaking, but the means scarcely exist yet for the completion of such an extensive scheme.

The long ascendancy of the Quakers in this state has stamped the manners of the people with a character of moderation and order. Factions are less violent here than in the other states, and personal animosities *less* rancorous. The Pensilvanians are less obstinate, selfish, and determined, than the people of New England, and less rash and impetuous than the inhabitants of the southern states. They are, comparatively speaking, obliging, well informed, and liberal in their opinions; but not distinguished for generosity, a high spirit, or warmth of character. They have abolished slavery, however, and have always been conspicuously active in works of humanity, and in promoting useful improvements. There is perhaps no part of the United States in which an emigrant from Europe will feel himself more comfortable than in Pensilvania, so far as depends on the character of the people.

In the Philosophical Transactions for 1757, there is an account of a spring in Pensilvania, which rises from a copper mine, and yields 800 hogsheads in twenty-four hours. The water is of a pale green colour, of an acid, sweet, austere, inky, and nauseous taste. The saline matter which it holds in solution is probably sulphate of copper; for a piece of polished iron immersed in it is soon covered with a crust of metallic copper. It contains also, it is said, copperas or sulphate of iron.

Among the other curiosities of this province may be reckoned another spring, about 14 feet deep, and about 100 square in the neighbourhood of Reading. A full mill stream flows from it. The waters are clear, and full of fishes. From appearances it is probable that this spring is the opening or outlet of a very considerable river, which, a mile and a half or two miles above this place, sinks into the earth, and is conveyed to this outlet in a subterranean channel. In the northern parts of Pensilvania there is a creek, called *Oil creek*, which empties into the Alleghany river. It issues from a spring, on the top of which floats an oil similar to that called Barbadoes tar, and from which one man may gather several gallons in a day. The troops sent to guard the western posts halted at this spring, collected some of the oil, and bathed their joints with it. This gave them great relief from the rheumatic complaints with which they were affected. The waters, of which the troops drank freely, operated as a gentle purge.

There are three remarkable grottoes or caves in this state; one near Carlisle in Cumberland county; one in the township of Durham, in Bucks county; and the other at Swetara in Lancaster county. Of the two former there are no particular descriptions. The latter is on the east bank of Swetara river, about two miles above its confluence with the Susquehanna. Its entrance is spacious, and descends so much as that the surface of the river is rather higher than the bottom of the cave. The vault of this cave is of a solid limestone rock, perhaps 20 feet thick. It contains several apartments, some of them very high and spacious. The water is incessantly percolating through the roof, and falls in drops to the bottom of the cave. These drops petrify as they fall, and have gradually formed solid pillars, which appear as supports to the roof. Thirty years ago there were ten such pillars, each six inches in diameter, and six feet high; all so ranged that the place they enclosed resembled a sanctuary in a Roman church. No royal throne ever exhibited more grandeur than this *lusus naturæ*. The resemblances of several monuments are found indented in the walls on the sides of the cave, which appear like the tombs of departed heroes. Suspended from the roof is *the bell* (which is nothing more than a stone projected in an unusual form), so called from the sound that it occasions when struck, which is similar to that of a bell. Some of the stalactites are of a colour like sugar-candy, and others resemble loaf sugar; but their beauty is much defaced by the country people. The water, which percolates through the roof, so much of it as is not petrified in its course, runs down the declivity, and is both pleasant and wholesome to drink. There are several holes in the bottom of the cave, descending perpendicularly, perhaps into an abyss below, which renders it dangerous to walk without a light. At the end of the cave is a pretty brook, which, after a short course, loses itself among the rocks. Beyond this brook is an outlet from the cave by a very narrow aperture. Through this the vapours continually pass outwards with a strong current of air, and ascend, resembling at night the smoke of a furnace. Part of these vapours and fogs appear on ascending to be condensed at the head of this great alembic, and the more volatile parts to be carried off, through the aperture communicating with the exterior air before mentioned, by the force of the air in its passage.

PENSION, a sum of money paid annually for services or considerations already past. The yearly payment of each member to the houses of the inns of courts are likewise named *pensions*; and the yearly assembly of the society of Gray's Inn, to consult on the affairs of the house, is also called a *pension*.

PENSIONARY, or PENSIONER, a person who has an appointment or yearly sum, payable during life, by way of acknowledgment, charged on the estate of a prince, company, or particular person.

Grand PENSIONARY, an appellation formerly given to the first minister of the states of Holland. The grand pensionary was chairman in the assemblies of the states of that province; he proposed the matters to be consulted on; collected the votes; formed and pronounced the resolutions of the states; opened letters; conferred with foreign ministers, &c. His business was also to inspect the finances, to maintain the authority of the states, and to see that the laws were observed; and he was perpetual deputy of the states general of the United Provinces. His commission was, however, only given him for five years; after which it was deliberated whether or not it should be renewed; but there was no instance of its being revoked; therefore death only put an end to the functions of this important minister.

PENSIONARY was also the first minister of the regency of each city in Holland. His office was to give his advice in affairs relating to the government, either of the state in general, or of the city in particular; and in assemblies of the states of the province, he was speaker in behalf of his city. The function, however, of these pensionaries was not everywhere alike; in some cities they only gave their advice, and were never found in assemblies of the magistrates, except when expressly called hither; in others they attended constantly; and in others they made the propositions on the part of the burgomasters, drew up their conclusions, &c. They were called *pensionaries*, because they received an appointment or pension.

PENSIONER, in general, denotes a person who receives a pension, yearly salary, or allowance. Hence,

The Band of Gentlemen PENSIONERS, the noblest sort of guard to the king's person, consists of 40 gentlemen, who receive a yearly pension of 100l.

This honourable band was first instituted by King Henry VIII. and their office is to attend the king's person, with their battle axes, to and from his chapel royal, and to receive him in the presence chamber, or coming out of his privy lodgings; they are also to attend at all great solemnities, as coronations, St George's feast, public audiences of ambassadors, at the sovereign's going to parliament, &c.

They are each obliged to keep three double horses and a servant, and so are properly a troop of horse. They wait half at a time quarterly; but on Christmas-day, Easter-day, Whitsunday, &c. and on extraordinary occasions, they are all obliged to give their attendance. They have likewise the honour to carry up the sovereign's dinner on the coronation-day and St George's feast; at which times the king or queen usually confer the honour of knighthood on two such gentlemen of the band as their captain presents.

Their arms are gilt battle-axes; and their weapons, on horseback, in time of war, are cuirassiers arms, with sword and pistols. Their standard in time of war is, argent, a cross gules. Their captain is always a nobleman, who has under him a lieutenant, a standard-bearer, a clerk of the check, secretary, paymaster, and harbinger.

Pensioner, in the university of Cambridge and in that of Dublin, has a very peculiar meaning; for those students, either under graduates or bachelors of arts, are called *pensioners*, who live wholly at their own expence, and who receive no emolument whatever from the college of which they are members. They are divided into two kinds, the *greater* and the *less;* the former of which are generally called *fellow-commoners*, because they eat with the fellows of their college; the latter are always called *pensioners*, and eat with the scholars, who are those students of the college, either under-graduates or bachelors who are upon the foundation, who receive emoluments from the society, and who are capable of being elected fellows. See Servitor and Sizar.

PENSTOCK, a sluice or flood-gate, serving to retain or let go at pleasure the water of a mill-pond, or the like.

PENTACHORD (compounded of πεντε, *five*, and χορδη, *string*), an ancient musical instrument with five strings. The invention of the pentachord is referred to the Scythians; the strings were of bullocks leather, and they were struck with a plectrum made of goats horn.

PENTACROSTIC, in *Poetry*, a set of verses so disposed, as that there are always five acrostics of the same name, in five divisions of each verse. See Acrostic.

PENTADACTYLON, Five Fingers, in *Botany*, a name given by some authors to the *ricinus* or *palma Christi*, from the figure of its leaf.

PENTADACTYLOS piscis, the *five-fingered fish*, the trivial name of a fish common in all the seas of the East Indies, and called by the Dutch there *viif vinger visch*.

PENTAGON, in *Geometry*, a figure of five sides and five angles. See Geometry.

In fortification, pentagon denotes a fort with five bastions.

PENTAGRAPH, Pantograph, or Pantographer, an instrument designed for drawing figures in what proportion you please, without any skill in the art.

The instrument is otherwise called a *parallelogram*. The following is the description of this instrument by Mr Adams.

Geomet. and Graphic Essays, p. 374.

"It is an instrument (says Mr Adams) as useful to the experienced draftsman, as to those who have made but little progress in the art. It saves a great deal of time, either in reducing, enlarging, or copying of the same size, giving the outlines of any drawing, however crooked or complex, with the utmost exactness; nor is it confined to any particular kind, but may with equal facility be used for copying figures, plans, sea-charts, maps, profiles, landscapes, &c.

"*Description and use of the Pantographer.*—I have not been able to ascertain who was the inventor of this useful instrument. The earliest account I find is that of the Jesuit Scheiner, about the year 1631, in a small tract entitled *Pantographice, sive ars nova delineandi.* The principles are self-evident to every geometrician; the mechanical construction was first improved and brought to its present state of perfection by *my father*, about the year 1750. It is one, among many other scientific improvements and inventions completed by him, that others have ingloriously, and many years after, assumed to themselves.

Pl
CCC

"The pantographer is usually made of wood, or brass, and consists of four flat rules, two of them long, and two short. The two longest are joined at the end A, by a double pivot, which is fixed to one of the rules, and works in two small holes placed at the end of the other. Under the joint is an ivory castor, to support this end of the instrument. The two smaller rules are fixed by pivots at E and H, near the middle of the larger rules, and are also joined together at their other end, G.

"By the construction of this instrument, the four rules always form a parallelogram. There is a sliding box on the longer arm, and another on the shorter arm. These boxes may be fixed at any part of the rules by means of their milled nuts; each of these boxes is furnished with a cylindric tube, to carry either the tracing point or crayon or fulcrum.

"The fulcrum or support K, is a leaden weight inclosed in a mahogany box, on this the instrument moves when in use; there are two moveable rollers, to support and facilitate the motions of the pantographer; their situation may be varied as occasion requires.

"The graduations are placed on two of the rules: on each of them are two scales, the fiducial edges of the boxes are to be set to these, according to the work to be performed by the instrument.

"The crayon, the tracer, and fulcrum, must in all cases be in a right line, so that when they are set, if a string be stretched over them, and they do not coincide with it, there is an error either in the setting or graduations.

"The long tube which carries the pencil or crayon, moves easily up or down another tube; there is a string affixed to the long or inner tube, passing afterwards through the holes in the three small knobs to the tracing point, where it may, if necessary, be fastened. By pulling this string, the pencil is lifted up occasionally, and thus prevented from making false or improper marks upon the copy.

"*To use this instrument when the copy is to be of the same size as the original.*—Place the instrument upon a large table, and set the sliding boxes B and D, to the divisions marked 12. Put the crayon into the box B, place the box D upon the fulcrum or leaden foot; the tracing point at C. Then lay a piece of paper under the crayon, and the original drawing under the tracer, and move the tracing point over the principal strokes of the original, and the crayon will form the required copy.

"*To reduce a drawing, &c. to half the size of the original.*—Set the boxes B and D, to the divisions marked one-half, place the fulcrum at B, the crayon at D, and tracer at C.

"*To reduce a drawing, &c. to less than one-half the original.*—Suppose one-third, one-fourth, one-fifth, &c. Place the fulcrum at B, crayon at D, and tracer at C, and slide the boxes B and D, to the divisions marked one-third, one-fourth, one-fifth, &c. *on the longer scales.* It may be proper to observe here, that if the copy be less than one-half the original, or when it is required greater than the original, the longer scales are to be used.

" *For greater than one-half the original drawing.*— Suppose it be required to make a drawing, two-thirds three-fourths, four-fifths, &c. Set the boxes, B and D, to corresponding divisions, as two-thirds, three-fourths, four-fifths, &c. *on the shorter scales*, place the fulcrum at D, the crayon at B, and tracer at C.

" *When the original drawing is to be enlarged.*— Suppose one-eighth, one sixth, &c. set the boxes B and D, to one-eighth, one-sixth, &c. *on the longer scales*, place the fulcrum at D, the crayon at C, and tracer at B.

" *Where the copy is required of a size differing from the fractional parts laid down on the instrument.*—For this purpose there are two scales laid down, containing 100 unequal parts, one scale numbered from 10 to 80, the other from 50 to 100.

" *If the copy is to be under one-half the original size*, place the boxes B and D, to any two corresponding divisions under 50, the fulcrum at B, and crayon at D.

" *If the copy is to be larger than one-half the original*, place the boxes B and D, to corresponding divisions between 50 and 100; the fulcrum at B, and crayon at D.

" *To change the situation of the pantographer.*—Copy first as much as the pantographer will take in; then make three points on the original, and as many corresponding points on the copy. Then remove the fulcrum to another situation, but so, that when the tracing point is applied to the three points marked on the original, the crayon may exactly coincide with the other three points on the copy, and proceed as before; and so on for every change in the situation of your instrument, and by this means a pantographer of two feet and a half in length will copy a drawing of any size whatsoever."

PENTAMETER, in ancient poetry, a kind of verse, consisting of five feet, or metres, whence the name. The two first feet may be either dactyls or spondees at pleasure; the third is always a spondee; and the two last anapestes: such is the following verse of Ovid.

1 2 3 4 5
Carmini | bus vi | ves tem | pus in om | ne meis.

A pentameter verse subjoined to an hexameter, constitutes what is called *elegiac*. See ELEGIAC.

PENTANDRIA (from πεντε, *five*, and ανηρ, *a man* or *husband*); the name of the fifth class in Linnæus's sexual method, consisting of plants which have hermaphrodite flowers, with five stamina or male organs. See BOTANY *Index*.

PENTAPETALOUS, an appellation given to flowers which consist of five petals or leaves.

PENTAPETES, a genus of plants belonging to the monadelphia class, and in the natural method ranking under the 37th order, *Columniferæ*. See BOTANY *Index*.

PENTAPOLIS. This name is given to the five cities, Sodom, Gomorrah, Adamah, Zeboim, and Zoar (Wisdom x. 6.). They were all five condemned to utter destruction, but Lot inteceded for the preservation of Zoar, otherwise called *Bala*. Sodom, Gomorrah, Adamah, and Zeboim, were all consumed by fire from heaven, and in the place where they stood was made the lake Asphaltites, or the lake of Sodom.

PENTAPOLIS (Ptolemy), a district of Cyrenaica; situated on the Mediterranean; denominated from its five cities; namely, Berenice, Arsinoe, Ptolemais, Cyrene, and Apollonia.

PENTAPOLIS of the Philistines, (Josephus); taking name from five principal cities, Gaza, Gath, Ascalon, Azotus, and Ekron.

PENTATEUCH. This word, which is derived from the Greek Πεντατευχος, from πεντε, *five*, and τευχος, an *instrument* or *volume*, signifies the collection of the five instruments or books of Moses, which are Genesis, Exodus, Leviticus, Numbers, and Deuteronomy: each of which books we have given an account of under their several names.

There are some modern critics who have disputed Moses's right to the Pentateuch. They observe that the author speaks always in the third person. " Now the man Moses was very meek above all the men which were upon the face of the earth. The Lord spake unto Moses, saying, &c. Moses said to Pharaoh, &c." Thus they think he would never have spoken of himself; but would at least sometimes have mentioned himself in the first person. Besides this, say they, the author of the Pentateuch sometimes abridges his narration like a writer who collected from some ancient memoirs. Sometimes he interrupts the thread of his discourse; for example, he makes Lamech the bigamist to say (Gen. iv. 23.), " Hear my voice, ye wives of Lamech, hearken unto my speech; for I have slain a man to my wounding, and a young man to my hurt," without informing us before-hand to whom this is related. These observations, for example (Gen. xii. 6.), " And the Canaanite was then in the land," cannot be reconciled to the age of Moses, since the Canaanites continued to be the masters of Palestine all the time of Moses. The passage out of the book of the wars of the Lord, quoted in the book of Numbers (xxi. 14.) seems to have been clapped in afterwards, as also the first verses of Deuteronomy. The account of the death of Moses, which is at the end of the same book, cannot certainly belong to this legislator; and the same judgment may be made of other passages, wherein it is said, that the places mentioned lay beyond Jordan; that the bed of Og was at Ramah to this day: that the havoth of Jair, or the cities of Jair, were known to the author, though probably they had not that name till after Moses's time (Numb. xxxii. 41. Deut. iii. 14.).

It is observed also in the text of the Pentateuch, that there are some places that are defective; for example, in Exodus (xii. 8.), we see Moses speaking to Pharaoh, where the author omits the beginning of his discourse. The Samaritan inserts in the same place what is wanting in the Hebrew. In other places, the same Samaritan copy adds what is deficient in the Hebrew text; and what it contains more than the Hebrew seems so well connected with the rest of the discourse, that it would be difficult to separate them. Lastly, they believe that they observe certain strokes in the Pentateuch which can hardly agree with Moses, who was born and bred in Egypt; as what he says of the earthly paradise; of the rivers that watered it, and ran through it; of the cities of Babylon, Erech, Resen, and Calneh; of the gold

gold of Pison, of the bdellium, of the stone of Sohem, or onyx-stone, which was to be found in that country. These particulars, observed with such curiosity, seem to prove, that the author of the Pentateuch lived beyond the Euphrates. Add what he says concerning the ark of Noah, of its construction, of the place where it rested, of the wood wherewith it was built, of the bitumen of Babylon, &c. But in answer to all these objections, we may observe in general, from an eminent writer * of our own country, that these books are by the most ancient writers ascribed to Moses; and it is confirmed by the authority of heathen writers themselves, that they are of his writing: besides this, we have the unanimous testimony of the whole Jewish nation, ever since Moses's time, from the first writing of them. Divers texts of the Pentateuch imply that it was written by Moses; and the book of Joshua, and other parts of scripture, import as much; and though some passages have been thought to imply the contrary, yet this is but a late opinion, and has been sufficiently confuted by several learned men. The Samaritans receive no other scriptures but the Pentateuch, rejecting all the other books which are still in the Jewish canon.

PENTATHLON, in antiquity, a general name for the five exercises performed at the Grecian games, viz. wrestling, boxing, leaping, running, and playing at the discus.

PENTECOST, a solemn festival of the Jews; so called, because it was celebrated on the 50th day after the 16th of Nisan, which was the second day of the passover. The Hebrews called it *the feast of weeks*, because it was kept seven weeks after the passover. They then offered the first fruits of the wheat harvest, which was then completed: besides which they presented at the temple seven lambs of that year, one calf, and two rams, for a burnt-offering; two lambs for a peace-offering; and a goat for a sin-offering (Levit. xxiii. 15, 16. Exod. xxxiv. 22. and Deut. xvi. 9, 10.). The feast of Pentecost was instituted among the Israelites, first to oblige them to repair to the temple of the Lord, there to acknowledge his absolute dominion over the whole country, and to offer him the first-fruits of their harvest; and, secondly, that they might call to mind, and give thanks to God, for the law which he had given them from Mount Sinai, on the 50th day after their coming out of Egypt.

The modern Jews celebrate the Pentecost for two days. They deck the synagogue and their own houses with garlands of flowers. They hear a sermon or oration in praise of the law, which they suppose to have been delivered on this day. The Jews of Germany make a very thick cake, consisting of seven layers of paste, which they call *Sinai*. The seven layers represent the seven heavens, which they think God was obliged to reascend from the top of this mountain. See *Leo of Modena* and *Buxtorf's synag. Jud.*

It was on the feast of Pentecost that the Holy Ghost miraculously descended on the apostles of our Lord, who were assembled together after his ascension in a house at Jerusalem (Acts ii.).

PENTHESILEA, queen of the Amazons, succeeded Orythia, and gave proofs of her courage at the siege of Troy, where she was killed by Achilles. Pliny says that she invented the battle-axe.

PENTHORUM, in *Botany*, a genus of the pentagynia order, belonging to the pentandria class of plant The calyx is quinquefid; there are either five peta or none; the capsule is five-pointed and quinquel cular.

PENTLAND, or **PICTLAND FRITH**, is a narro strait of six miles between the mainland of Scotland a the Orkney isles. This strait is the great thoroughfa of shipping between the eastern and western seas, t terror of mariners, and has been the grave of thousand The navigation of this frith was formerly extreme dangerous by the island of Stroma, and two rocks calle the *Skerries*, lying near the middle of it; but it is no greatly improved, and comparatively safe, in consequen of a lighthouse erected on the Skerries.

PENULA, among the ancient Romans, was a coar garment or cloak worn in cold or rainy weather. was shorter than the lacerna, and therefore more prop for travellers. It was generally brown, and succeede the toga after the state became monarchical. Augustu abolished the custom of wearing the penula over t toga, considering it as too effeminate for Romans; a the ædiles had orders to suffer none to appear in t circus or forum with the lacerna or penula. Write are not agreed as to the precise difference between the two articles of dress; but we are told that they we chiefly worn by the lower orders of people. See LACERNA.

PENULTIMA, or *PENULTIMATE Syllable*, in *Gra mar*, denotes the last syllable but one of a word; a hence the antepenultimate syllable is the last but tw or that immediately before the penultima.

PENUMBRA, in *Astronomy*, a partial shade served between the perfect shadow and the full light an eclipse. It arises from the magnitude of the su body: for were he only a luminous point, the shado would be all perfect; but, by reason of the diameter the sun, it happens, that a place which is not illumin ted by the whole body of the sun, does yet receive ra from a part thereof.

PEON, in the language of Hindostan, means a fo soldier, armed with sword and target. In common u it is a footman, so armed, employed to run before a p lanquin. *Piaaah* is the proper word; from which *pe* is a corruption.

PEOR, a famous mountain beyond Jordan, whi Eusebius places between Heshbon and Livias. T mountains Nebo, Pisgah, and Peor, were near o another, and probably made but the same chain mountains. It is very likely that Peor took its na from some deity of the same name, which was worshi ped there; for Peor, Phegor, or Baal-peor, was know in this country. See Numb. xxv. 3. Deut. iv. 3. Ps cv. 28.

PEOR, was a city of the tribe of Judah, which is n read in the Hebrew, nor in the Vulgate, but only in t Greek of the Septuagint (Josh. xv. 60.). Eusebius sa it was near Bethlehem, and Jerome adds, that in h time it was called *Paora*.

PEPIN DE HERISTAL, or **LE GROS**, mayor of t palace under Clovis III. Childebert, and Dagobe The power of these mayors in France was so great, th they left the sovereign only the empty title, and in t end seized on the throne itself.

PEPIN [illegible] *Br*[illegible], or *le Petit*, grandson to Pepin t Gros, and first king of the second race of French m narch

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* *Jenkin's Reasonableness of Christianity.*

PLATE CCCCIX.

PERAMBULATOR.

Fig. 1.

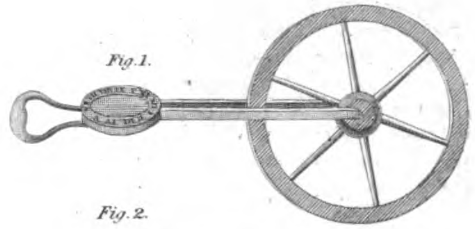
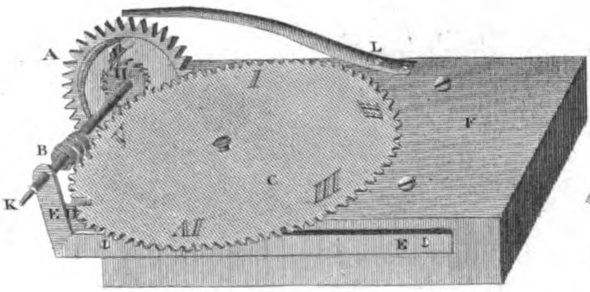
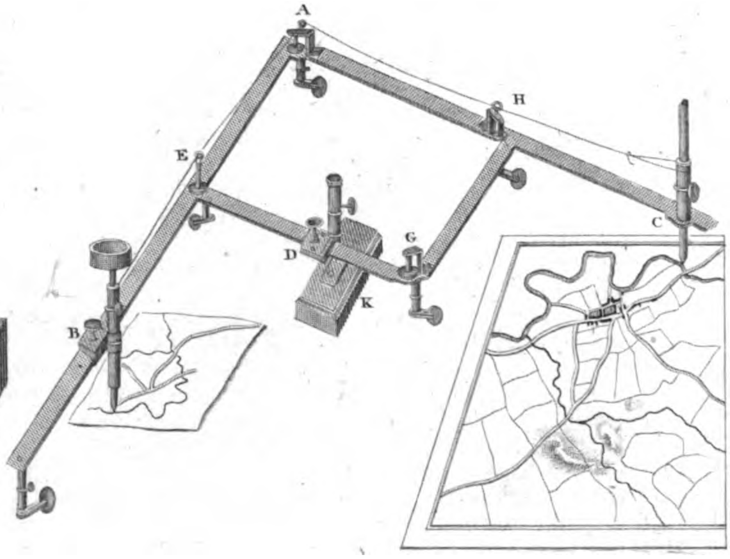


Fig. 2.



PENTAGRAPH.



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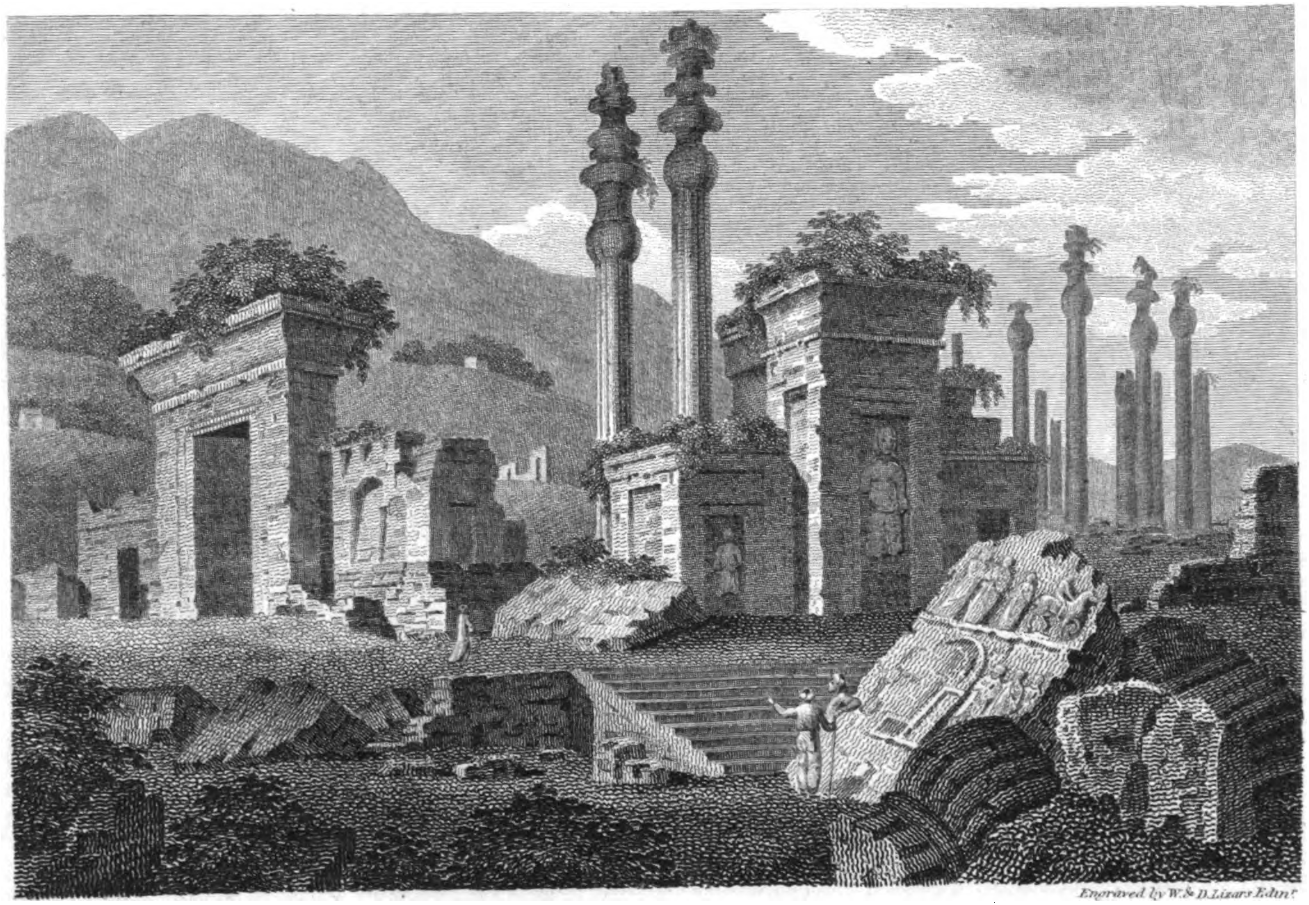

Engraved by W. & D. Lizars Edinr.

narchs, was mayor of the palace to Childeric III. a weak prince: he contrived to confine him and his son Thierri in different monasteries: and then, with the assistance of Pope Stephen III. he usurped the sovereign power. He died in 768, aged 54.

PEPLIS, a genus of plants belonging to the hexandria class, and in the natural method ranking under the 17th order, *Calycanthemæ*. See BOTANY *Index*.

PEPLUS, a long robe worn by the women in ancient times, reaching down to the feet, without sleeves, and so very fine, that the shape of the body might be seen through it. The Athenians used much ceremony in making the peplus, and dressing the statue of Minerva with it. Homer makes frequent mention of the peplus of that goddess.

PEPPER, PIPER, in *Natural History*, an aromatic berry of a hot quality, chiefly used in seasoning. We have three kinds of pepper at present used in the shops, the black, the white, and the long pepper.

Black pepper is the fruit of the piper, and is brought from the Dutch settlements in the East Indies. See PIPER, BOTANY *Index*.

The common white pepper is factitious, being prepared from the black in the following manner: they steep this in sea-water, exposed to the heat of the sun for several days, till the rind or outer bark loosens; they then take it out, and, when it is half dry, rub it till the rind falls off; then they dry the white fruit, and the remains of the rind blow away like chaff. A great deal of the heat of the pepper is taken off by this process, so that the white kind is more fit for many purposes than the black. However, there is a sort of native white pepper produced on a species of the same plant; which is much better than the factitious, and indeed little inferior to the black.

The long pepper is a dried fruit, of an inch or an inch and a half in length, and about the thickness of a large goose quill: it is of a brownish gray colour, cylindrical in figure, and said to be produced on a plant of the same genus.

Pepper is principally used by us in food, to assist digestion: but the people in the East Indies esteem it as a stomachic, and drink a strong infusion of it in water by way of giving them an appetite: they have also a way of making a fiery spirit of fermented fresh pepper with water, which they use for the same purposes. They have also a way of preserving the common and long pepper in vinegar, and eating them afterwards at meals.

Jamaica PEPPER, or *Pimento*. See LAURUS, BOTANY *Index*.

PEPPER-*Mint*. See MENTHA, BOTANY and MATERIA MEDICA *Index*.

PEPPER-*Pot*. See CAPSICUM, BOTANY *Index*.

PEPPER-*Water*, a liquor prepared in the following manner, for microscopical observations: Put common black pepper, grossly powdered, into an open vessel so as to cover the bottom of it half an inch thick, and put to it rain or river water till it covers it an inch; shake or stir the whole well together at the first mixing, but never disturb it afterwards: let the vessel be exposed to the air uncovered; and in a few days there will be seen a pellicle or thin skin swimming on the surface of the liquor, presenting several colours.

This is a congeries of multitudes of small animals; and being examined by the microscope, will be seen all in motion: the animals, at first sight, are so small as not to be distinguishable, unless to the greatest magnifiers; but they grow daily till they arrive at their full size. Their numbers are also continually increasing, till the whole surface of the liquor is full of them, to a considerable depth. When disturbed, they will sometimes all dart down to the bottom; but they soon after come up to the surface again. The skin appears soonest in warm weather, and the animals grow the quickest: but in the severest cold it will succeed, unless the water freezes.

About the quantity of a pin's head of this scum, taken up on the nib of a new pen, or the tip of a hair-pencil, is to be laid on a plate of clear glass; and if applied first to the third magnifier, then to the second, and finally to the first, will show the different animalcules it contains, of several kinds and shapes as well as sizes.

PEPPERMINT-TREE. See EUCALYPTUS, BOTANY *Index*.

PERA, one of the suburbs of Constantinople, where ambassadors and Christians usually reside. See CONSTANTINOPLE.

PERAMBULATOR, in surveying, an instrument for measuring distances, called also *odometer*, *pedometer*, *way-wiser*, and *surveying-wheel*.

Plate CCCCIX. fig. 1.

It consists of a wheel AA, fig. 1. two feet seven inches and a half in diameter; consequently half a pole, or eight feet three inches, in circumference. On one end of the axis is a nut, three quarters of an inch in diameter, and divided into eight teeth; which, upon moving the wheel round, fall into the eight teeth of another nut *c*, fixed on one end of an iron-rod Q, and thus turn the rod once round in the time the wheel makes one revolution. This rod, lying along a groove in the side of the carriage of the instrument, under the dotted line, has at its other end a square hole, into which is fitted the end *b* of a small cylinder P. This cylinder is disposed under the dial-plate of a movement, at the end of the carriage B, in such a manner as to be moveable about its axis: its end *a* is cut into a perpetual screw, which falling into the 32 teeth of a wheel perpendicular thereto, upon driving the instrument forward, that wheel makes a revolution each 16th pole. On the axis of this wheel is a pinion with six teeth, which falling into the teeth of another wheel of 60 teeth, carries it round every 160th pole, or half a mile.

This last wheel, carrying a hand or index round with it over the divisions of a dial-plate, whose outer limb is divided into 160 parts, corresponding to the 160 poles, points out the number of poles passed over. Again, on the axis of this last wheel is a pinion, containing 20 teeth, which falling into the teeth of a third wheel which hath 40 teeth, drives it once round in 320 poles, or a mile. On the axis of this wheel is a pinion of 12 teeth, which, falling into the teeth of a fourth wheel having 72 teeth, drives it once round in 12 miles.

This fourth wheel, carrying another index over the inner limb of the dial-plate, divided into 12 for miles, and each mile subdivided into halves, quarters, and furlongs, serves to register the revolutions of the other hand, and to keep account of the half miles and miles passed over as far as 12 miles.

The use of this instrument is obvious from its construction. Its proper office is in the surveying of roads and large distances, where a great deal of expedition, and not much accuracy, is required. It is evident, that driving it along and observing the hands, has the same effect as dragging the chain and taking account of the chains and links.

Its advantages are its hardiness and expedition; its contrivance is such, that it may be fitted to the wheel of a coach, in which state it performs its office, and measures the road without any trouble at all.

The following is a description of an instrument invented by Mr Edgeworth for the same purpose.

"This odometer," says Mr Edgeworth, "is more simple than any which I have seen, is less liable to be out of order, and may be easily attached to the axle-tree bed of a post-chaise, gig, or any other carriage.

Fig. 2.

"One turn and a half of a screw is formed round the nave of one of the hinder wheels by a slip of iron three quarters of an inch broad and one-eighth of an inch thick; this is wound round the nave, and fastened to it by screws passing through five or six cocks, which are turned up at right angles on the slip of iron. The helix so formed on the nave of the carriage wheel acts as a worm or screw upon the teeth of the wheel A, fig. 2. upon the arbor of which another screw of brass B is formed, which acts upon the brass wheel C. This wheel C serves also as a dial-plate, and is divided into miles, halves, quarters, and furlongs; the figures indicating the miles are nearly three quarters of an inch long, so as to be quite distinct; they are pointed out by the index D, which is placed as represented in the plate, in such a manner as to be easily seen from the carriage.

"These two brass wheels are mounted by the irons EE upon a block of wood F, eight inches long, two inches thick; and five inches broad. This block may be screwed upon the axle-tree-bed by two strong square-headed wood screws. If the carriage permits, this block should be fixed obliquely on the axle-tree-bed, so that the dial-plate may be raised up toward the eye of the person looking out from the carriage.

"H is a ratchet wheel attached to the arbor of the wheel A, which, by means of the click I, allows the wheel to be set with a key or handle fitted to the squared end of the arbor at K. L is a long spring screwed on the block; it presses on the wheel A, to prevent it from shaking by the motion of the carriage. A small triangular spring is put under the middle of the dial-plate wheel for the same purpose.

"If the wheel of the carriage is exactly five feet three inches in circumference, the brass-toothed wheel which it turns should have twenty teeth, and that which serves as a dial plate should have eighty; it will then count five miles. If the carriage wheel is either larger or smaller, a mile should be carefully measured on a smooth road, and the number of turns which the carriage wheel makes in going this mile may easily be counted by tying a piece of fine packthread to one of the spokes, and letting the wheel, as it moves slowly forward, wind up the packthread on its nave. When the wheel has proceeded a half or a quarter of a mile, unwind the string and count the number of turns which it has made.

"By the addition of another wheel of eighty-one teeth placed under the dial-plate wheel, and moved by the screw C, with a proper hand fitted to it, and proper figures on the dial-plate, this machine would count four hundred miles *."

It has been supposed that the ancient Romans were acquainted with an instrument of this kind. The foundation of this opinion is an expression of Julius Capitolinus in his life of the emperor Pertinax. The words are, *Et alia* (*vehicula*), *iter metientia, et horas monstrantia.*" "Carriages for measuring the length of the road, and marking the time of the journey."

PERCA, the PERCH; a genus of fishes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

PERCEPTION, is a word which is so well understood, that it is difficult for the lexicographer to give any explanation of it. It has been called the first and most simple act of the mind by which it is conscious of its own ideas. This definition, however, is improper, as it confounds perception with consciousness; although the objects of the former faculty are things without us, those of the latter the energies of our own minds. Perception is that power or faculty by which, through the medium of the senses, we have the cognizance of objects distinct and apart from ourselves, and learn that we are but a small part in the system of nature. By what process the senses give us this information, we have endeavoured to show elsewhere, (see METAPHYSICS, Part I. chap. i.); and we should not again introduce the subject, but to notice a singular opinion of a very able writer, whose work has been given to the public since our article alluded to had issued from the press.

Dr Sayers has endeavoured to prove that no man can perceive two objects, or be conscious of two ideas at the same instant. If this be true, not only our theory of time (see METAPHYSICS, Part II. chap. vii.) is grossly absurd, but even memory itself seems to be an imaginary faculty. If a man be not conscious of his present existence, at the very instant when he thinks of a past event, or reviews a series of past transactions, it is difficult, to us indeed impossible, to conceive what idea he can have of time, or what he can mean when he says that he remembers a thing. But let us examine the reasoning by which the ingenious author endeavours to establish his opinion.

"If we reflect (says he †) upon the surprising velocity with which ideas pass through the mind, and the remarkable rapidity with which the mind turns itself, or is directed from one object of contemplation to another, this might alone give us some suspicion that we may probably be mistaken in supposing ideas to be synchronously perceived. Other arguments may be adduced to strengthen this suspicion. It will be granted, I believe, that the mind, whether immaterial or the result of organization, has certainly a wholeness or unity belonging to it, and that it is either not composed of parts, or that no one of the parts from which it originates is itself mind: in this case, it is difficult to conceive how two ideas should be impressed upon the mind at the same instant: for this would be supposing that part of the mind could receive one idea, and part another, at the same time; but if the parts do not perceive singly, this is evidently impossible. If, on the other hand, this self-division of the mind does not take place, then if two ideas are nevertheless to be perceived at the same instant, it would seem that those ideas must be so blended with each other, that neither of them could appear distinct. If we examine the manner in which a complex idea is perceived, we shall find very clearly, that the whole of such an idea is never present to the mind at once. In thinking of a centaur, for instance,

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* Nich. Jour. 15. 81.

† D tion phy and rary

stance, can we at the same moment be thinking of the parts of a man and the parts of a horse? Can we not almost detect the gliding of the mind from the one to the other? In contemplating the complex idea of gold, are the ideas of its colour, ductility, hardness, and weight, all present to the mind at the same instant? I think, if we accurately attended to it, we shall find a perceptible time has elapsed before this complex idea has been perfectly formed in our mind: but if all the parts of a complex idea cannot be recalled at the same instant, is it not reasonable to infer that these parts are also singly impressed, and not all originally perceived at the same instant?"

This reasoning is plausible, but perhaps not convincing. Surely we have all been conscious of bodily pain or pleasure with our eyes open, and been offended by disagreeable smells at the very instant that we looked at objects beautifully coloured. That our ideas pass through the mind with great velocity, and that the mind can rapidly turn itself from one subject of contemplation to another, are truths which cannot be controverted; but instead of leading us to suppose that two or more objects cannot be synchronously perceived, or two or more ideas synchronously apprehended, they appear to furnish a complete proof of the reverse of all this. For we beg leave to ask how we come to know that ideas pass with velocity through the mind, if we be not all the while conscious of something that is permanent? If we can contemplate but one idea at once, it is plainly impossible that two or more can be compared together; and therefore we cannot possibly say that any particular train has passed through the mind with a degree of velocity greater or less than that which we have usually experienced; nay, we cannot say that we have ever experienced a train of ideas at all, or even been conscious of a single idea, besides the immediate object of present apprehension. That the mind is an individual, we most readily grant; but that it should therefore be incapable of having *two* ideas synchronously excited in it, is a proposition for which the author has brought no evidence. That it is difficult to conceive *how* this is done, we acknowledge; but not that it is more difficult than to conceive how a *single* idea is excited in the mind; for of the mode in which mind and matter mutually operate on each other, we can form no conception. We know that objects make an impression on the organs of sense, that this impression is by the nerves communicated to the brain, and that the agitation of the brain excites sensation in the mind: but in *what way* it excites sensation we know not; and therefore have no reason to suppose that two or more different agitations may not excite two or more synchronous sensations, as well as one agitation excites one sensation. That the agitation given to the brain operates on the mind, is known by experience; but experience gives us no information repecting the *mode* of that operation. If the mind be, as our author and we suppose, one individual, it cannot, as mind, be either divisible or extended; and therefore it is certain that the operation in question cannot be, in the proper sense of the word, impression. Hence we have no right to infer, if two objects be perceived at once, either that the idea of the one must be impressed on a part of the mind different from that which receives the impression of the other, or that the two impressions must be so blended with each other, that neither of them could appear distinct; for this would be to reason from one mode of operation to another; with which, upon acknowledged principles, it can have nothing in common.

By far the greater part of our ideas are relicts of *visible* sensations; and of every thing which we can actually see at once, we at once contemplate the idea. That we could at once perceive a centaur, if such a being were presented to us, cannot surely be doubted by any one who has ever looked at a man on horseback; and therefore that we can at the same moment contemplate the whole idea of a centaur, is a fact of which consciousness will not permit us to doubt.—If, indeed, we choose to analyze this complex idea into its component parts, it is self evident that the mind must glide from the one to the other, because the very analysis consists in the separation of the parts, of which, if after that process we think of them, we must think in succession: but that we may have at the same instant, either an actual or ideal view of all the parts of the centaur united, is a proposition so evident as to admit of no other proof than an appeal to experience. In contemplating what the author calls the complex idea of gold, it cannot be denied that the ideas of its colour, ductility, hardness, and weight, are never all present to the mind at the same instant: but the reason is obvious. These are not all *ideas*, in the proper sense of the word, but some of them are ideas, and some notions, acquired by very different processes and very different faculties. Colour is an idea of sensation, immediately suggested through the organ of sight; ductility is a relative notion, acquired by repeated experiments; and gold might be made the object of every sense, without suggesting any such notion. The writer of this article never saw any experiment made on the ductility of gold, and has therefore a very obscure and indistinct notion of that property of the metal; but he is conscious, that he can perceive, at the same instant, the yellow colour and circular figure of a guinea, and have a very distinct, though relative notion, of its hardness.

We conclude, therefore, that the mind is capable of two or more synchronous perceptions, or synchronous ideas; that during every train which passes through it, it is conscious of its own permanent existence; and that if it were limited to the apprehension of but one idea at once, it could have no remembrance of the past, or anticipation of the future, but would appear to itself, could it make any comparison, to pass away like a flash of lightning.

PERCH, in land-measuring, a rod or pole of 16½ feet in length, of which 40 in length and 4 in breadth make an acre of ground. But, by the customs of several counties, there is a difference in this measure. In Staffordshire it is 24 feet; and in the forest of Sherwood 25 feet, the foot being there 18 inches long; and in Herefordshire a perch of ditching is 21 feet, the perch of walling 16½ feet, and a pole of denshiered ground is 12 feet, &c.

PERCH, a fish. See PERCA, ICHTHYOLOGY *Index*.

PERCHE, a territory of Orleannois in France, 35 miles long, and 30 broad; bounded on the north by Normandy; on the south, by Maine and Dunois; on the east, by Beauce; and on the west by Maine. It takes its name from a forest, and is pretty fertile. The inhabitants carry on a pretty good trade; and the principal town is Bellesme.

PERCOLATION, a chemical operation which is the same with FILTRATION.

PERCUSSION, in *Mechanics*, the impression a body makes in falling or striking upon another; or the shock of two bodies in motion. See DYNAMICS and MECHANICS.

PERDICIUM, a genus of plants, belonging to the syngenesia class; and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

PERDIX, the partridge. See TETRAO, ORNITHOLOGY *Index*.

PEREASLAW, a strong populous town of Poland, in the palatinate of Kiovia, situated on the river Tribecz; in E. Long. 32. 44. N. Lat. 49. 46.

PERENNIALS, or PERENNIAL FLOWERS, in *Botany*, a term applied to those plants whose roots abide many years, whether they retain their leaves in winter or not. Those which retain their leaves are called *ever-greens*; but such as cast their leaves are named *deciduous* or *perdifols*.

PERFECT, something to which nothing is wanting, or that has all the requisites of its nature and kind.

PERFECT *Cadence*, in *Music*. See CADENCE.

PERFECT *Tense*, in *Grammar*. See PRETERITE.

PERFECTION, the state or quality of a thing PERFECT.

Perfection is divided, according to Chauvinus, into physical, moral, and metaphysical.

Physical or natural perfection, is that whereby a thing has all its powers and faculties, and those too in full vigour; and all its parts both principal and secondary, and those in their due proportion, constitution, &c. in which sense man is said to be perfect when he has a sound mind in a sound body. This perfection is by the schools frequently termed ενεργητικη, because a thing is enabled thereby to perform all its operations.

Moral perfection is an eminent degree of virtue or moral goodness, to which men arrive by repeated acts of piety, beneficence, &c. This is usually subdivided into absolute or inherent, which is actually in him to whom we attribute it; and imputative, which exists in some other, and not in him it is attributed to.

Metaphysical, transcendental, or essential perfection, is the possession of all the essential attributes, or of all the parts necessary to the integrity of a substance; or it is that whereby a thing has or is provided of every thing belonging to its nature. This is either absolute, where all imperfection is excluded, such is the perfection of God; or *secundum quid*, and in its kind.

PERFORANS MANUS.	See ANATOMY, *Table of the Muscles*.
PERFORANS *Pedis*.	
PERFORATUS MANUS.	
PERFORATUS *Pedis*.	

PERFUME, denotes either the volatile effluvia from any body affecting the organ of smelling, or the substance emitting those effluvia; in which last sense the word is most commonly used. The generality of perfumes are made up of musk, ambergris, civet, rose and cedar woods, orange-flowers, jessamines, jonquils, tuberoses, and other odoriferous flowers. Those drugs commonly called aromatics, such as storax, frankincense benzoin, cloves, mace, &c. enter the composition of a perfume; some are alo composed of aromatic herbs or leaves, as lavender, marjoram, sage, thyme, hyssop, &c.

The use of perfumes was frequent among the Hebrews, and among the orientals in general, before it was known to the Greeks and Romans. In the time of Moses perfumes must have been known in Egypt, since he speaks of the art of the perfumer, and gives the composition of two kinds of perfumes (Exod. xxx. 25.), of which one was to be offered to the Lord upon the golden altar which was in the holy place; and the other was appointed for the anointing of the high priest and his sons (*ibid.* 34, &c.) as also of the tabernacle, and all the vessels that were used in divine service.

The Hebrews had also perfumes which they made use of in embalming their dead. The composition is not known, but it is certain that they generally made use of myrrh, aloes, and other strong and astringent drugs, proper to prevent putrefaction (John xix. 49.). See the article EMBALMING.

Besides the perfumes for these purposes, the Scripture mentions other occasions whereon the Hebrews used perfumes. The spouse in the Canticles (i. 3.) commends the scent of the perfumes of her lover; and her lover in return says, that the scent of the perfumes of his spouse surpasses the most excellent odours (*id.* iv. 10—14.). He names particularly the spikenard, the calamus, the cinnamon, the myrrh, and the aloes, as making a part of these perfumes. The voluptuous woman described by Solomon (Prov. vii. 17.) says, that she had perfumed her bed with myrrh, aloes, and cinnamon. The epicures in the book of Wisdom (ii. 7.) encourage one another to the luxuriant use of odours and costly perfumes.

Isaiah (lvii. 9.) reproaches Judea, whom he describes as a spouse faithless to God, with being painted and perfumed to please strangers, "Thou wentest to the king with ointment, and didst increase thy perfumes." Ezekiel (xxiii. 41.) seems to accuse the Jews with having profaned the odours and perfumes, the use of which was reserved to sacred things, by applying them to their own use.

They came afterwards to be very common among the Greeks and Romans, especially those composed of musk, ambergris, and civet. The *nardus* and *malobathrum* were held in much estimation, and were imported from Syria. The *unguentum nardinum* was variously prepared, and contained many ingredients. *Malobathrum* was an Indian plant. Perfumes were also used at sacrifices to regale the gods; at feasts, to increase the pleasures of sensation; at funerals, to overpower cadaverous smells, and please the manes of the dead; and in the theatres, to prevent the offensive effluvia, proceeding from a crowd, from being perceived.

Since people are become sensible of the harm they do to the head, perfumes are generally disused among us; however, they are still common in Spain and Italy.

PERGAMA, (Virgil), the citadel of Troy; which, because of its extraordinary height, gave name to all high buildings (Servius). Others say the walls of Troy were called *Pergama*.

PERGAMUM, (Pliny); called also *Pergamea*, (Virgil); *Pergamia*, (Plutarch; a town of Crete, built by Agamemnon in memory of his victory, (Velleius). Here was the burying-place of Lycurgus (Aristoxenus, quoted by Plutarch). It was situated near Cydonia (Servius); to what point not said: but Scylax helps him out, who places the Dactynnean temple of Diana, which stood near Cydonia (Strabo), to the north of the territory of Pergamia.—Another PERGAMUM (Pliny, Strabo); a town of Mysia, situated on the Caïcus, which runs by it. It was the royal residence of Eumenes, and of the kings of the Attali (Livy). There an ancient temple of Æsculapius stood; an asylum (Tacitus). The ornament of Pergamum was the royal library, vying with that of Alexandria in Egypt; the kings of Pergamum and Egypt rivalling each other in this respect (Pliny). Strabo ascribes this rivalry to Eumenes. Plutarch reckons up 200,000 volumes in the library at Pergamum. Here the *membranæ pergamenæ*, whence the name *parchment*, were invented for the use of books, (Varro, quoted by Pliny). The country of Galen, and of Oribasius chief physician to Julian the Apostate (Eunapius), called by some the *ape of Galen*. Here P. Scipio died (Cicero). Attalus son of Eumenes dying without issue, bequeathed his kingdom to the Roman people, who reduced it to a province, (Strabo). *Pergameus*, the epithet (Martial). Here was one of the nine *conventus juridici*, or assemblies of the *Asia Romana*, called *Pergamenus*, and the ninth in order (Pliny); which he also calls *jurisdictio Pergamena.*

PERGAMUS, an ancient kingdom of Asia, formed out of the ruins of the empire of Alexander the Great. It commenced about the year 283 B. C. The first sovereign was one Philetærus an eunuch, by birth a Paphlagonian, of a mean descent, and in his youth a menial servant to Antigonus one of Alexander's captains. He afterwards served Lysimachus king of Macedon and Thrace, who appointed him keeper of his treasures lodged in Pergamus. While he held this employment, having fallen under the displeasure of Arsinoe wife to Lysimachus, she found means to make a quarrel between him and his master; upon which Philetærus seized on the castle of Pergamus, together with the treaures entrusted to his care, amounting to 90,000 talents. At first he offered his service, together with his treasure, to Seleucus king of Syria: but both Seleucus and Lysimachus dying soon after, he kept possession of the town and treasure also till his death; which happened 20 years after his revolt from Lysimachus.

Philetærus left the city of Pergamus to his brother, or, according to some, to his brother's son Eumenes I. and he, laying hold of the opportunity offered by the dissensions among the Seleucidæ, possessed himself of many strong-holds in the province of Asia; and having hired a body of Galatians, defeated Antiochus as he was returning from a victory gained over his brother Seleucus Callinicus. By this victory he obtained possession of the greater part of Asia: however, he did not long enjoy his acquisitions; for he died next year of immoderate drinking, a vice to which he was greatly addicted.

Eumenes was succeeded by Attalus I. nephew of Philetærus, and the first who took upon him the title of king of Pergamus. He defeated the Gauls, who were desirous of settling in his territory; and, according to Livy, was the first of the Asiatic princes who refused to pay a contribution to these barbarians. When Seleucus Ceraunus was engaged in other wars, he invaded his territories, and conquered all the provinces on this side of Mount Taurus; but was soon driven out of his new acquisitions by Seleucus and his grandfather Achæus, who entering into an alliance against him, deprived him of all his newly acquired territories, and even besieged him in his capital. Upon this Attalus invited to his assistance the Gauls who had settled in Thrace: and with their help not only obliged the enemy to raise the siege of Pergamus, but quickly recovered all the provinces he had lost. After this he invaded Ionia and the neighbouring provinces, where several cities voluntarily submitted to him. The Teians, Colophonians, with the inhabitants of Egea and Lemnos, sent deputies declaring themselves ready to acknowledge him for their sovereign; the Carsenes, on the other side the river Lycus, opened their gates to him, having first expelled the governor set over them by Achæus. From thence he advanced to Apia, and encamping on the banks of the river Megithus, received homage from the neighbouring nations. But here the Gauls being frightened by an eclipse of the moon, refuse to proceed farther; which obliged Attalus to return to the Hellespont, where he allowed his allies to settle, giving them a large and fruitful territory, and promising that he would always assist and protect them to the utmost of his power.

Attalus having thus settled his affairs with equal honour and advantage to himself, entered into an alliance with Rome, and afterwards joined them in their war against Philip king of Macedon. Here he had the command of the Rhodian fleet; with which he not only drove the Macedonians quite out of the seas, but having landed his men, he, in conjunction with the Athenians, invaded Macedon, and obliged Philip to raise the siege of Athens, which he had greatly distressed; for which services the Athenians not only heaped on him all the favours they could, but called one of their tribes by his name; an honour they had never bestowed on any foreigner before.

Attalus, not contented with all he had yet done against Philip, attempted to form a general confederacy of the Greeks against him. But while he was haranguing the Bœotians to this purpose, and exhorting them with great vehemence to enter into an alliance with the Romans against their common enemy, he fell down speechless. However he came to himself again, and desired to be carried by sea from Thebes to Pergamus, where he died soon after his arrival, in the 72d year of his age and 43d of his reign.

This prince was a man of great generosity, and such an enthusiast in learning and learned men, that he caused a grammarian named *Daphidas* to be thrown into the sea from the top of a high rock, because he spoke disrespectfully of Homer.

Attalus was succeeded by his eldest son Eumenes II. He was exceedingly attached to the Romans, insomuch that he refused the daughter of Antiochus the Great in marriage, lest he should thus have been led into a difference with that people. He also gave notice to the Roman senate of the transactions of Ariarathes king of Cappadocia, who was making great preparations both by sea and land. Nor did Eumenes stop here; for when he saw the war about to break out between Antiochus and the Romans, he sent his brother Attalus to Rome to give information of the proceedings of Antiochus. The senate heaped honours both on Eumenes and his brother; and in the war which followed, gave the command of their fleet to the king of Pergamus in conjunction with C. Livius Salinator. The victory gained on this occasion was in a great measure owing to Eumenes, who boarded some of the enemy's ships in person, and during the whole action behaved with uncommon bravery. Some time afterwards Eumenes, entering the territories of Antiochus with a body of 5000 men, ravaged all the country about Thyatira, and returned with an immense booty. But in the mean time Antiochus invading Pergamus in his turn, ravaged the whole country, and even laid siege to the capital. Attalus, the king's brother, held out with a handful of men till the Achæans, who were in alliance with Eumenes, sent 1000 foot and 100 horse to his assistance. As this small body of auxiliaries were all chosen men, and commanded by an experienced officer, they behaved with such bravery that the Syrians were obliged to raise the siege. At the battle of Magnesia, too, Eumenes behaved with the greatest bravery: not only sustaining the first attack of the enemy's elephants, but driving them back again on their own troops, which put the ranks in disorder, and gave the Romans an opportunity of giving them a total defeat by attacking them opportunely with their horse. In consequence of this defeat, Antiochus was obliged to conclude a peace with the Romans on such terms as they pleased to prescribe; one of which was, that he should pay Eumenes 400 talents, and a quantity of corn, in recompense for the damage he had done him.

Eumenes now thought of obtaining some reward from the Romans equivalent to the services he had done them. Having gone to Rome, he told the senate, that he was come to beg of them that the Greek cities which had belonged to Antiochus before the commencement of the late war, might now be added to his dominions; but his demand was warmly opposed by the ambassadors from Rhodes, as well as by deputies from all the Greek cities in Asia. The senate, however, after hearing both parties, decided the matter in favour of Eumenes, adding to his dominions all the countries on this side of Mount Taurus which belonged to Antiochus; the other provinces lying between that mountain and the river Mæander, excepting Lycia and Caria, were bestowed on the Rhodians. All the cities, which had paid tribute to Attalus, were ordered to pay the same to Eumenes; but such as had been tributary to Antiochus were declared free.

Soon after this Eumenes was engaged in a war with Prusias king of Bithynia, who made war upon him by the advice of Hannibal the celebrated Carthaginian general. But Eumenes, being assisted by the Romans, defeated Prusias in an engagement by sea, and another by land; which so disheartened him, that he was ready to accept of peace on any terms. However, before the treaty was concluded, Hannibal found means to draw Philip of Macedon into the confederacy, who sent Philocles, an old and experienced officer, with a considerable body of troops to join Prusias. Hereupon Eumenes sent his brother Attalus to Rome with a golden crown, worth 15,000 talents, to complain of Prusias for making war on the allies of the Roman people without any provocation. The senate accepted the present, and promised to adjust every thing to the satisfaction of their friend Eumenes, whom they looked upon to be the most steady ally they had in Asia. But in the mean time Prusias, having ventured another sea-fight, by a contrivance of Hannibal's gained a complete victory. The Carthaginian commander advised him to fill a great many earthen vessels with various kinds of serpents and other poisonous reptiles, and in the heat of the fight to throw them into the enemies ships so as to break the pots and let the serpents loose. All the soldiers and seamen were commanded to attack the ship in which Eumenes was, and only to defend themselves as well as they could against the rest; and that they might be in no danger of mistaking the ship, a herald was sent before the engagement with a letter to the king. As soon as the two fleets drew near, all the ships of Prusias, singling out that of Eumenes, discharged such a quantity of serpents into it, that neither soldiers nor sailors could do their duty, but were forced to fly to the shore, lest they should fall into the enemy's hands. The other ships, after a faint resistance, followed the king's example, and were all driven ashore with great slaughter, the soldiers being no less annoyed by the stings of the serpents, than by the weapons of the enemy. The greatest part of the ships of Eumenes were burnt, several taken, and the others so much shattered that they became quite unserviceable. The same year Prusias gained two remarkable victories over Eumenes by land, both of which were entirely owing to stratagems of Hannibal. But, while matters were thus going on to the disadvantage of Eumenes, the Romans interfered, and by their deputies not only put an end to the differences between the two kings, but prevailed on Prusias to betray Hannibal; upon which he poisoned himself, as hath been related under the article HANNIBAL.

Eumenes being thus freed from such a dangerous enemy, engaged in a new war with the kings of Cappadocia and Pontus, in which also he proved victorious. His friendship for the Romans he carried to such a degree of enthusiasm, that he went in person to Rome to inform them of the machinations of Perses king of Macedon. He had before quarrelled with the Rhodians, who sent ambassadors to Rome to complain of him. But as the ambassadors happened to arrive while the king himself was present in the city, the Rhodian ambassadors could not obtain any hearing, and Eumenes was dismissed with new marks of favour. This journey, however, had almost proved fatal to him; for, on his return, as he was going to perform a sacrifice at Delphi, two assassins, sent by Perses, rolled down two great stones upon him as he entered the straits of the mountains. With one he was dangerously wounded on the head, and with the other on the shoulder. He fell with the blows from a steep place, and thus received many other bruises; so that he was carried on board his ship when it could not well be known whether he was dead or alive. His people, however, soon finding that he was still alive, conveyed him to Corinth, and from Corinth to Ægina, having caused their vessels to be carried over the isthmus.

Eumenes remained at Ægina till his wounds were cured, which was done with such secrecy, that a report of his death was spread all over Asia, and even believed at Rome; nay, his brother Attalus was so convinced of the truth of this report, that he not only assumed the government, but even married Stratonice the wife of Eumenes. But in a short time Eumenes convinced them both of his being alive, by returning to his kingdom. On the receipt of this news, Attalus resigned the sovereignty in great haste, and went to meet his brother; carrying a halberd, as one of his guards. Eumenes received both him and the queen with great tenderness, nor did he ever say any thing which might tend to make them uneasy; only it is said he whispered in his brother's ear when he first saw him, "Be in no haste to marry my wife again till you are sure that I am dead."

The king being now more than ever exasperated against Perses, joined the Romans in their war against him; but during the course of it he suddenly cooled in his affection towards those allies whom he had hitherto served with so much zeal, and that to such a degree, that he admitted ambassadors from Perses, and offered to stand neuter if he would pay him 1000 talents, and for 1500, to influence the Romans to grant him a safe and honourable peace. But these negociations were broke off without effect, by reason of the distrust which the two kings had of one another. Eumenes could not trust Perses unless he paid him the money beforehand; while, on the other hand, Perses did not care to part with the money before Eumenes had performed what he promised; neither could he be induced to pay the sum in question, though the king of Pergamus offered to give hostages for the performance of his promise. What the reason of such a sudden change in the disposition of Eumenes was, is nowhere told; however, the fact is certain. The negociations above mentioned were concealed from the Romans as long as possible; but they soon came to be known: after which the republic began to entertain no small jealousy of their old friend, and therefore heaped favours on his brother Attalus, without taking any notice of the king himself. Eumenes had sent him to Rome to congratulate the senate on the happy issue of the war with Perses, not thinking that his practices had been discovered. However, the senate without taking any notice of their disaffection to Eumenes at first, entertained Attalus with the greatest magnificence; then several of the senators who visited him proceeded to acquaint him with their suspicions of the king, and desired Attalus to treat with them in his own name, assuring him, that the kingdom of Pergamus would be granted him, if he demanded it, by the senate. These speeches had at first some effect; but Attalus, being of an honest disposition, and assisted by the advice of a physician called *Stratius*, a man of great probity, resolved not to comply with their desire. When he was admitted to the senate, therefore, he first congratulated them on the happy issue of the Macedonian war, then modestly recounted his own services; and lastly, acquainted them with the motive of his journey; intreated them to send ambassadors to the Gauls, who by their authority might secure his brother from any danger of their hostilities; and he requested them also, that the two cities of Ænus and Maronea might be bestowed on himself. The senate, imagining that Attalus designed to choose some other day to sue for his brother's kingdom, not only granted all his requests, but sent him richer and more magnificent presents than they had ever done before. Upon this Attalus immediately set out on his return to Pergamus; which so provoked the senators, that they declared the cities free which they had promised to Attalus, thus rendering ineffectual their promise which they were ashamed openly to revoke; and as for the Gauls, who were on all occasions ready to invade the kingdom of Pergamus, they sent ambassadors to them, with instructions to behave in such a manner as would rather tend to encourage them in their design than dissuade them from it.

Eumenes, being alarmed at those proceedings, resolved to go in person to Rome, in order to justify himself. But the senate having already condemned him in their own minds, resolved not to hear his vindication. For this reason, as soon as they heard of his design, they made an act that no king should be permitted to enter the gates of Rome. Eumenes, however, who knew nothing of this act, set forward on his journey, and landed at Brundusium; but no sooner did the Roman senate get intelligence of his arrival there, than they sent a quæstor acquainting him with the decree of the senate; and telling him at the same time, that if he had any business to transact with the senate, he was appointed to hear it, and transmit it to them; but if not, that the king must leave Italy without delay. To this Eumenes replied, that he had no business of any consequence to transact, and that he did not stand in need of any of their assistance; and without saying a word more, went on board his ship, and returned to Pergamus.

On his return home, the Gauls, being encouraged by the cold reception which he had met with at Rome, invaded his territories, but were repulsed with great loss by the king, who afterwards invaded the dominions of Prusias, and possessed himself of several cities. This produced new complaints at Rome; and Eumenes was accused, not only by the ambassadors of Prusias, but also by those of the Gauls and many cities in Asia, of keeping a secret correspondence with Perses king of Macedon. This last charge was confirmed by some letters which the Romans themselves had intercepted; so that Eumenes found it impossible to keep up his credit any longer at Rome, though he sent his brothers Athenæus and Attalus thither to intercede for him. The senators, in short, had conceived the most implacable hatred against him, and seemed absolutely bent on his destruction, when he died, in the 39th year of his reign, leaving his kingdom and his wife to his brother Attalus. He left one son, but he was an infant, and incapable of governing the kingdom; for which reason Eumenes chose rather to give the present possession of the crown to his brother, reserving the succession to his son, than to endanger the whole by committing the management of affairs to his son's tutors.

Attalus, in the beginning of his reign, found himself greatly distressed by Prusias king of Bithynia, who not only overthrew him in a pitched battle, but advanced to the very walls of Pergamus, ravaging the country as he marched along; and at last reduced the royal city itself. The king, however, saved himself by a timely flight, and dispatched ambassadors to Rome, complaining of the bad usage of Prusias. The latter endeavoured to defend himself, and to throw the blame on Attalus.

lus. But, after a proper inquiry was made into the matter, Prusias was found to be entirely in the wrong; in consequence of which, he was at last obliged to conclude a peace with his adversary on the following terms. 1. That he should immediately deliver up to Attalus 20 ships with decks. 2. That he should pay 500 talents to Attalus within the space of 20 years. 3. That he should pay 100 talents to some of the other Asiatic nations by way of reparation for the damages they had sustained from him. And, 4. Both parties should be content with what they had before the beginning of the war.

Some time after this, Prusias having made an unnatural attempt on the life of his son Nicomedes, the latter rebelled, and with the assistance of Attalus, drove his father from the throne, and, as is said, even murdered him in the temple of Jupiter. The Romans took no notice of these transactions, but showed the same kindness to Attalus as formerly. The last enterprise in which we find Attalus engaged, was against Andriseus the pretended son of Perses king of Macedon, where he assisted the Romans; after which he gave himself up entirely to ease and luxury, committing state affairs entirely to his ministers; and thus continued to his death, which happened in the 82d year of his age, about 138 B. C.

Attalus II. was succeeded by Attalus III. the son of Eumenes; for the late king, considering that he only held the crown as a trust for his nephew, passed by his own children in order to give it to him, though he appears to have been by no means of worthy of it. He is said to have been deprived of his senses through the violence of his grief for his mother's death; and indeed, throughout his whole reign, he behaved more like a madman than any thing else. Many of his subjects of the highest quality were cut off with their wives and children, upon the most groundless suspicions; and for these executions he made use of mercenaries hired out from among the most barbarous nations. Thus he proceeded till he had cut off all the best men in the kingdom; after which he fell into a deep melancholy, imagining that the ghosts of those whom he had murdered were perpetually haunting him. On this he shut himself up in his palace, put on a mean apparel, let his hair and beard grow, and sequestered himself from all mankind. At last he withdrew from the palace, and retired into a garden, which he cultivated with his own hands, and filled with all sorts of poisonous herbs. These he used to mix with wholesome pulse, and send packets of them to such as he suspected. At last, being weary of this amusement, and living in solitude, because nobody durst approach him, he took it in his head to follow the trade of a founder, and make a brazen monument. But, while he laboured at melting and casting the brass, the heat of the sun and furnace threw him into a fever, which in seven days put an end to his tyranny, after he had sat on the throne five years.

On the death of the king, a will was found, by which he left the Roman people heirs of all his goods; upon which they seized on the kingdom, and reduced it to a province of their empire by the name of *Asia Proper*. But Aristonicus, a son of Eumenes by an Ephesian courtesan, reckoning himself the lawful heir to the crown, could by no means be satisfied with this usurpation of the Romans, and therefore assembled a considerable army to maintain his pretensions. The people in general, having been accustomed to a monarchy, dreaded a republican form of government; in consequence of which, they assisted Aristonicus, and soon put him in a condition to reduce the whole kingdom. The news, however, were soon carried to Rome; and Licinius Crassus, the pontifex maximus, was sent into the east, with orders to enforce obedience to the king's will. Historians take no notice of any forces which were sent along with this commander; whence it is supposed, that he depended on assistance from the Asiatics, who were in alliance with Rome, or from the Egyptians. But when he came thither, he found both the Syrians and Egyptians so reduced, that he could not expect any assistance from them. However, he was soon supplied with troops in plenty by the kings of Pontus, Bithynia, Cappadocia, and Paphlagonia; but managed matters so ill, that he was entirely defeated and taken prisoner. Those who took him, designed to carry him to Aristonicus; but he, not able to endure the disgrace, would have laid violent hands on himself if he had not been disarmed. However, being allowed to keep a rod for managing the horse on which he sat, he struck a Thracian soldier who stood near him so violently with it, that he beat out one of his eyes; upon which the other drew his sword, and run him through on the spot. His head was brought to Aristonicus, who exposed it to public view; but the body was honourably buried.

Aristonicus had no great time to enjoy the fruits of his victory. Indeed he behaved very improperly after it; for, instead of preparing to oppose the next army, which he might have been assured the Romans would send against him, he spent his time in feasting and revelling. But he was soon roused out of his lethargy by Perpenna the new consul, who having assembled with incredible expedition the troops of the allies, came unexpectedly upon him, obliged him to venture an engagement at a disadvantage, and entirely defeated him. Aristonicus fled to a city called *Stratonice*, but was so closely pursued by the conqueror, that the garrison having no method of supplying themselves with provisions, delivered up their leader, as well as a philosopher named *Blosius*, who had been the companion and counsellor of Aristonicus. The philosopher behaved with great resolution after being taken, and openly defended his siding with Aristonicus, because he thought his cause just. He exhorted the latter to prevent the disgrace and misery of captivity by a voluntary death; but Aristonicus, looking upon death as a greater misery than any captivity, suffered himself to be treated as his conquerors pleased.

In the mean time, a new consul named *Manius Aquilius*, being arrived from Rome, sent a most haughty message to Perpenna, requiring him immediately to deliver up Aristonicus, as a captive belonging to his triumph when the war should be ended. With this demand Perpenna refused to comply, and his refusal had almost produced a civil war. However, this was prevented by the death of Perpenna, which happened soon after the dispute commenced. The Pergamenians, notwithstanding the defeat and captivity of their leader, still held out with such obstinacy, that Aquilius was obliged to besiege, and take by force, almost every city in the kingdom. In doing this, he took a very effectual

tual, though exceeding cruel method. Most of the cities in the kingdom had no other water than what was brought from a considerable distance in aqueducts. These Aquilius did not demolish, but poisoned the water, which produced the greatest abhorrence of him throughout all the east. At last, however, the whole country being reduced, Aquilius triumphed, the unhappy Aristonicus was led in chains before his chariot, and probably ended his miserable life in a dungeon. The country remained subject to the Romans while their empire lasted, but is now in the hands of the Turks. The city is half ruined, and is still known by the name of *Pergamus*. It is inhabited by about 3000 Turks, and a few families of poor Christians. E. Long. 27. 27. N. Lat. 30. 3.

PERGUNNAH, in the language of Hindostan, means the largest subdivision of a province, whereof the revenues are brought to one particular *head Cutchery*, from whence the accounts and cash are transmitted to the general *Cutchery* of the province.

PERIAGOGE, in *Rhetoric*, is used where many things are accumulated into one period which might have been divided into several.

PERIAGUA, a kind of large canoe made use of in the Leeward islands, South America, and the gulf of Mexico. It is composed of the trunks of two trees hollowed and united together; and thus differs from the canoe, which is formed of one tree.

PERIANDER, tyrant of Corinth and Corcyra, was reckoned among the seven wise men of Greece; though he might rather have been reckoned among the most wicked men, since he changed the government of his country, deprived his countrymen of their liberty, usurped the sovereignty, and committed the most shocking crimes. In the beginning of his reign he behaved with mildness; but after his having sent to the tyrant of Syracuse to consult him on the safest method of government, he abandoned himself to cruelty. The latter, having heard Periander's envoys, took them into a field, and, instead of answering them, pulled up before them the ears of corn which exceeded the rest in height. Periander, on being told of this action, understood what was meant by it. He first secured himself by a good guard, and then put the most powerful Corinthians to death. He abandoned himself to the most enormous crimes; committed incest with his mother, kicked to death his wife Melissa, daughter of Procles king of Epidaurus, notwithstanding her being with child; and was so enraged at Lycophron, his second son, for lamenting his mother's death, that he banished him into the island of Corcyra. Yet he passed for one of the greatest politicians of his time; and Heraclides tells us, that he forbade voluptuousness; that he imposed no taxes, contenting himself with the custom arising from the sale and the import and export of commodities; that, though wicked himself, he hated the wicked, and caused all pimps to be drowned; lastly, that he established a senate, and settled the expence of its members. He died 585 B. C.

PERIANTHIUM, (from περι, "round," and ανθος, "the flower,") the flower cup properly so called, the most common species of calyx, placed immediately under the flower, which is contained in it as in a cup. See BOTANY *Index*.

PERICARDIUM, in *Anatomy*, a membranous bag filled with water, which contains the heart in man and many other animals. It is formed by a duplicature of the mediastinum, or membrane which divides the thorax into two unequal parts. See ANATOMY, N° 121.

PERICARPIUM, (from περι, "round," and καρπος, "fruit,") the seed-vessel; that organ of a plant containing the seeds, which it discharges when ripe. The seed-vessel is in fact the developed seed-bud, and may very properly be compared to the fecundated ovary in animals; for it does not exist till after the fertilizing of the seeds by the male dust, and the consequent fall of the flower. All plants, however, are not furnished with a seed-vessel; in such as are deprived of it, the receptacle or calyx performs its functions by inclosing the seeds as in a matrix, and accompanying them to perfect maturity.

PERICHORUS, in antiquity, a name given by the Greeks to their profane games or combats, that is, to such as were not consecrated to any of the gods.

PERICLES, was one of the greatest men that ever flourished in Greece. He was educated with all imaginable care; and beside other masters, he had for his tutors Zeno, Eleates, and Anaxagoras. He learned from the last of these to fear the gods without superstition, and to account for an eclipse from a natural cause. Many were unjust enough to suspect him of atheism, because he had perfectly studied the doctrine of that philosopher. He was a man of undoubted courage; and of such extraordinary eloquence, supported and improved by knowledge, that he gained almost as great an authority under a republican government as if he had been a monarch; but yet he could not escape the satirical strokes of the comic poets. His dissoluteness with women was one of the vices with which he was chiefly charged. He died the third year of the Peloponnesian war, after long sickness, which had weakened his understanding. Aspasia, Pericles's favourite, was a learned woman of Miletus: she taught Socrates rhetoric and politics. As Pericles cared not much for his wife, he willingly gave her up to another, and married Aspasia, whom he passionately loved.

PERICRANIUM, in *Anatomy*, a thick solid coat or membrane covering the outside of the cranium or skull. See ANATOMY, N° 4.

PERIGEE, in *Astronomy*, that point of the sun or moon's orbit wherein they are at the least distance from the earth; in which sense it stands opposed to apogee.

PERIGORD, a province of France, which makes part of Guienne, bounded on the north by Angoumois and a part of Marche, and on the east by Quercy and Limosin; on the south by Agenois and Bazadois; and on the west, by Bourledois, Angumois, and a part of Saintonge. It is about 83 miles in length, and 60 in breadth. It abounds in iron mines, and the air is pure and healthy. Perigueux is the capital town.

PERIGORD-Stone, is supposed to be an ore of manganese, of a dark gray colour, like basalt.

PERIGRAPHE, a word usually understood to express a careless or inaccurate delineation of any thing; but in Vesalius it is used to express the white lines or impressions that appear on the musculus rectus of the abdomen.

PERIGUEUX, an ancient town of France, capital of the province of Perigord, seated on the river Isle, in E. Long. 0. 33. N. Lat. 45. 18. It is remarkable for the ruins of the temple of Venus, and an amphitheatre.

PERIHELIUM, in *Astronomy*, that part of a planet or comet's orbit wherein it is in its least distance from the sun; in which sense it stands in opposition to aphelium.

PERIMETER, in *Geometry*, the bounds or limits of any figure or body. The perimeters of surfaces or figures are lines; those of bodies are surfaces. In circular figures, instead of perimeter, we say circumference, or periphery.

PERINÆUM, or PERINEUM, in *Anatomy*, the space between the anus and the parts of generation, divided into two equal lateral divisions by a very distinct line, which is longer in males than in females.

PERIOD, in *Astronomy*, the time taken up by a star or planet in making a revolution round the sun; or the duration of its course till it return to the same part of its orbit. See PLANET.

The different periods and mean distances of the several planets are as follows:

	Days.	h.	′	″	mean Dist.
Herschel	30737	18			1908352
Saturn	10759	1	51	11	954072
Jupiter	4332	14	27	10	520279
Mars	686	23	30	35	152369
Earth	365	6	9	12	100000
Venus	224	16	49	10	72333
Mercury	87	23	15	43	38710

There is a wonderful harmony between the distances of the planets from the sun, and their periods round him; the great law whereof is, that the squares of the periodical times of the primary planet, are to each other as the cubes of their distances from the sun? and likewise, the squares of the periodical times of the secondaries of any planet are to each other as the cubes of their distances from that primary. This harmony among the planets is one of the greatest confirmations of the Copernican hypothesis. See ASTRONOMY, p. 100 and 101.

For the periods of the moon, see MOON, ASTRONOMY *Index*.

The periods of several comets are now pretty well ascertained. See ASTRONOMY, N° 306.

PERIOD, in *Chronology*, denotes a revolution of a certain number of years, or a series of years, whereby, in different nations, and on different occasions, time is measured; such are the following.

Calippic PERIOD, a system of seventy-six years. See CALIPPIC, and ASTRONOMY, N° 11, &c.

Dionysian PERIOD, or *Victorian Period*, a system of 532 lunæ-solar and Julian years; which being elapsed, the characters of the moon fall again upon the same day and feria, and revolve in the same order, according to the opinion of the ancients.

This period is otherwise called the *great paschal cycle*, because the Christian church first used it to find the true time of the pascha or easter. The sum of these years arises by multiplying together the cycles of the sun and moon.

Hipparchus's PERIOD, is a series of 304 solar years, returning in a constant round, and restoring the new and full moons to the same day of the solar year, according to the sentiment of Hipparchus. This period arises by multiplying the Calippic period by four.—Hipparchus assumed the quantity of the solar year to be 365 days 5 hours 55′ 12″; and hence concluded, that in 104 years Calippus's period would err a whole day. He therefore multiplied the period by four, and from the product cast away an entire day. But even this does not restore the new and full moons to the same day throughout the whole period; but they are sometimes anticipated 1 day 8 hours 23′ 29″ 20‴. See ASTRONOMY, N° 14.

Julian PERIOD. See JULIAN.

PERIOD, in *Grammar*, denotes a small compass of discourse, containing a perfect sentence, and distinguished at the end by a point, or full stop, thus (.); and in members or divisions marked by commas, colons, &c.

Father Buffier observes two difficulties in the use of the period, or point; i. e. in distinguishing it from the colon, or double point; and in determining justly the end of a period, or perfect sentence. It is remarked that the supernumerary members of a period, separated from the rest by colons and semicolons, usually commence with a conjunction: yet it is true these same conjunctions sometimes rather begin new periods than supernumerary members of old ones. It is the sense of things, and the author's own discretion, that must make the proper distinction which of the two in effect it is. No rules will be of any service, unless this be admitted as one, that when what follows the conjunction is of as much extent as what precedes it, it is usually a new period; otherwise not.

The second difficulty arises hence, that the sense appears perfect in several short detached phrases, wherein it does not seem there should be periods; a thing prequent in free discourse: as, *We are all in suspense: make your proposals immediately: you will be to blame for detaining us longer.* Where it is evident, that simple phrases have perfect senses like periods, and ought to be marked accordingly; but that the shortness of the discourse making them easily comprehended, the pointing is neglected.

De Colonia defines period a short but perfect sentence, consisting of certain parts or members, depending one on another, and connected together by some common vinculum. The celebrated definition of Aristotle is, a period is a discourse which has a beginning, a middle, and an end, all visible at one view. Rhetoricians consider period, which treats of the structure of sentences, as one of the four parts of composition. The periods allowed in oratory are three: A period of two members, called by the Greeks *dicolos*, and by the Latins *bimembris;* a period of three members, *tricolos, trimembris;* and a period of four, *quadrimembris*, *tetracolos*. See PUNCTUATION.

PERIOD, in numbers, is a distinction made by a point or comma, after every sixth place, or figure; and is used in numeration, for the readier distinguishing and naming the several figures or places; which see under NUMERATION.

PERIOD, in *Medicine*, is applied to certain diseases which have intervals and returns, to denote an entire course or circle of such disease; or its progress from any state through all the rest till it return to the same again.

Galen describes period as a time composed of an intension and remission; whence it is usually divided into two parts, the paroxysm or exacerbation, and remission.

In intermitting fevers, the periods are usually stated and regular; in other diseases, as the epilepsy, gout, &c. they are vague or irregular.

Period, in *Oratory*. See there, Nº 47.

PERIODIC, or Periodical, something that terminates and comprehends a period; such is a periodic month; being the space of time wherein the moon dispatches her period.

PERIOECI, περιοικοι, in *Geography*, such inhabitants of the earth as have the same latitudes, but opposite longitudes, or live under the same parallel and the same meridian, but in different semicircles of that meridian, or in opposite points of the parallel. These have the same common seasons throughout the year, and the same phenomena of the heavenly bodies; but when it is noonday with the one, it is midnight with the other, there being twenty-four hours in an east or west direction. These are found on the globe by the hour-index, or by turning the globe half round, that is, 180 degrees either way.

PERIOSTEUM, or Periostium, in *Anatomy*, a nervous vascular membrane, endued with a very quick sense, immediately surrounding, in every part, both the internal and external surfaces of all the bones in the body, excepting only so much of the teeth as stand above the gums, and the peculiar places on the bones in which the muscles are inserted. It is hence divided into the external and internal periosteum; and where it externally surrounds the bones of the skull, it is generally called the *pericranium*. See Anatomy *Index*.

PERIPATETICS, philosophers, followers of Aristotle, and maintainers of the peripatetic philosophy; called also *Aristotelians*. Cicero says, that Plato left two excellent disciples, Xenocrates and Aristotle, who founded two sects, which only differed in name: the former took the appellation of *Academics*, who were those that continued to hold their conferences in the Academy, as Plato had done before; the others, who followed Aristotle, were called *Peripatetics*, from περιπατεω, "I walk;" because they disputed walking in the Lyceum.

Ammonius derives the name Peripatetic from Plato himself, who only taught walking; and adds, that the disciples of Aristotle, and those of Xenocrates, were equally called Peripatetics; the one Peripatetics of the Academy, the other Peripatetics of the Lyceum: but that in time the former quitted the title Peripatetic for that of Academic, on account of the place where they assembled; and the latter retained simply that of Peripatetic. The greatest and best part of Aristotle's philosophy was borrowed from Plato. Serranus asserts, and says he could demonstrate, that there is nothing exquisite in any part of Aristotle's philosophy, dialectics, ethics, politics, physics, or metaphysics, but is found in Plato. And of this opinion are many of the ancient authors, such as Clemens Alexandrinus, &c. Gale attempts to show, that Aristotle borrowed a good deal of his philosophy, both physical, about the first matter, and metaphysical about the first being, his affections, truth, unity, goodness, &c. from the Scriptures; and adds from Clearchus, one of Aristotle's scholars, that he made use of a certain Jew, who assisted him therein.

Aristotle's philosophy preserved itself *in puris naturalibus* for a long time: in the earlier ages of Christianity, the Platonic philosophy was generally preferred; but this did not prevent the doctrine of Aristotle from forcing its way into the Christian church. Towards the end of the fifth century, it rose into great credit; the Platonics interpreting in their schools some of the writings of Aristotle, particularly his dialectics, and recommending them to young persons. This appears to have been the first step to that universal dominion which Aristotle afterwards obtained among the learned, which was at the same time much promoted by the controversies which Origen had occasioned. This father was zealously attached to the Platonic system; and therefore, after his condemnation, many, to avoid the imputation of his errors, and to prevent their being counted among the number of his followers, openly adopted the philosophy of Aristotle. Nor was any philosophy more proper for furnishing those weapons of subtle distinctions and captious sophisms, which were used in the Nestorian, Arian, and Eutychian controversies. About the end of the sixth century, the Aristotelian philosophy, as well as science in general, was almost universally decried; and it was chiefly owing to Boetius, who explained and recommended it, that it obtained a higher degree of credit among the Latins than it had hitherto enjoyed. Towards the end of the seventh century, the Greeks abandoned Plato to the monks, and gave themselves up entirely to the direction of Aristotle; and in the next century, the Peripatetic philosophy was taught everywhere in their public schools, and propagated in all places with considerable success. John Damascenus very much contributed to its credit and influence, by composing a concise, plain, and comprehensive view of the doctrines of the Stagirite, for the instruction of the more ignorant, and in a manner adapted to common capacities. Under the patronage of Photius, and the protection of Bardas, the study of philosophy for some time declined, but was revived again about the end of the ninth century. About the middle of the 11th century, a revolution in philosophy commenced in France; when several famous logicians, who followed Aristotle as their guide, took nevertheless the liberty of illustrating and modelling anew his philosophy, and extending it far beyond its ancient limits. In the 12th century, three methods of teaching philosophy were in use by the different doctors: the first was the ancient and plain method, which confined its researches to the philosophical notions of Porphyry, and the dialectic system, commonly attributed to St Augustine, and in which was laid down this general rule, that philosophical inquiries were to be limited to a small number of subjects, lest by their becoming too extensive, religion might suffer by a profane mixture of human subtilty with its divine wisdom. The second method was called the Aristotelian, because it consisted in explications of the works of that philosopher, several of whose books being translated into Latin, were almost everywhere in the hands of the learned. The third was termed the free method, employed by such as were bold enough to search after truth, in the manner the most adapted to render their inquiries successful, without rejecting the succours of Aristotle and Plato. A reformed system of the Peripatetic philosophy was first introduced into the schools in the university of Paris, from whence it soon spread throughout Europe; and has subsisted in some universities even to this day, under the name of *school philosophy*. The foundation thereof is Aristotle's doctrine, often misunderstood, but oftener misapplied: whence the retainers thereto may be denominated *Reformed Peripatetics*. Out of these have sprung, at various times, several branches; the chief are, the THOMISTS, SCOTISTS, and NOMINALISTS. See these articles.

The Peripatetic system, after having prevailed with great and extensive dominion for many centuries, began rapidly to decline towards the close of the 17th, when the disciples of Ramus attacked it on the one hand, and it had still more formidable adversaries to encounter in Descartes, Gassendi, and Newton. See PHILOSOPHY.

PERIPATON, in antiquity, the name of that walk in the Lyceum where Aristotle taught, and whence the name of Peripatetics given to his followers.

PERIPETIA, in the drama, that part of a tragedy wherein the action is turned, the plot unravelled, and the whole concludes. See CATASTROPHE.

PERIPHERY, in *Geometry*, the circumference of a circle, ellipsis, or any other regular curvilinear figure. See GEOMETRY.

PERIPHRASIS, circumlocution, formed of περι, "about," and φραζω, "I speak;" in rhetoric, a circuit or tour of words, much affected by orators, to avoid common and trite manners of expression. The periphrasis is of great use on some occasions; and it is often necessary to make things be conceived which are not proper to name. It is sometimes polite to suppress the names, and only intimate or design them. These turns of expression are also particularly serviceable in oratory; for the sublime admitting of no direct citations, there must be a compass taken to insinuate the authors whose authority is borrowed. A periphrasis, by turning round a proper name to make it understood, amplifies and raises the discourse; but care must be taken it be not too much swelled, nor extended, *mal à propos;* in which case it becomes flat and languid. See CIRCUMLOCUTION and ORATORY.

PERIPLOCA, VIRGINIAN SILK: a genus of plants belonging to the pentandria class; and in the natural method ranking under the 30th order, *Contortæ*. See BOTANY *Index*.

PERIPNEUMONY, Περιπνευμονια, formed from περι, "about," and πνευμων, "lungs," in *Medicine*, an inflammation of some part of the thorax, properly of the lungs; attended with an acute fever, and a difficulty of breathing. See MEDICINE, N° 184.

PERIRRHANTERIUM, a vessel of stone or brass which was filled with holy water, and with which all those were sprinkled who were admitted by the ancients to their sacrifices. Beyond this vessel no profane person was allowed to pass. We are told by some, that it was placed in the *adytum*, or inmost recess of the temple; others say it was placed at the door, which indeed seems to be the most likely opinion. It was used both by Greeks and Romans, and has been evidently borrowed, like many other Pagan ceremonies, by the church of Rome. The Hebrews also had a vessel for purification.

PERISCII, in *Geography*, the inhabitants of either frigid zone, between the polar circles and the poles, where the sun, when in the summer signs, moves only round about them, without setting; and consequently their shadows in the same day turn to all the points of the horizon.

PERISTALTIC, a vermicular spontaneous motion of the intestines, performed by the contraction of the circular and longitudinal fibres of which the fleshy coats of the intestines are composed; by means whereof the chyle is driven into the orifices of the lacteal veins, and the fæces are protruded towards the anus.

PERISTYLE, in *Ancient Architecture*, a building encompassed with a row of columns on the inside.

PERITONÆUM, in *Anatomy*, is a thin, smooth, and lubricous membrane, investing the whole internal surface of the abdomen, and containing most of the viscera of that part as it were in a bag. See ANATOMY *Index*.

PERITROCHIUM, in *Mechanics*, denotes a wheel or circle, concentric with the base of a cylinder, an moveable together with it about its axis. See MECHANICS.

PERJURY, in *Law*, is defined by Sir Edward Cok to be a crime committed when a lawful oath is administered, in some judicial proceeding, to a person wh swears wilfully, absolutely, and falsely, in a matter material to the issue or point in question. In ancient time it was in some places punished with death; in others i made the false swearer liable to the punishment due t the crime he had charged the innocent person with; i others a pecuniary mulct was imposed. But though i escaped human, yet it was thought, amongst the ancient in general, that the divine vengeance would most certainly overtake it; and there are many severe infliction from the hand of God upon record, as monuments the abhorrence in which this atrocious crime is held b the Deity. The souls of the deceased were supposed t be employed in punishing perjured persons. Even th inanimate creation was thought to take revenge for thi crime. The Greeks supposed that no person could swea falsely by Styx without some remarkable punishment and that no person guilty of perjury could enter th cave of Palæmon at Corinth without being made a memorable example of divine justice. In Sicily, at th temple of the Palici, there were fountains called *Dell* from which issued boiling water, with flames and ball of fire; and we are told that if any person swore falsely near them, he was instantly struck dumb, blind, lame or dead, or was swallowed up by the waters. But although perjury was thus held in general abhorrence notwithstanding the credit which was given to such accounts of divine inflictions, it was so much practise by the Greeks, that *Græra fides* became a proverb Lovers perjuries, however, were supposed to pass unnoticed, or to be very slightly punished with blackness o the nails, a decayed tooth, or some small diminution o beauty.

The ancient philosophers, however, were so afraid o perjury, that even an oath before a judge was never admitted but for want of other proof. Plato's precep was, "Not to administer an oath wantonly, but on dee grounds, and with the strictest caution." Ulpian give his opinion thus: "Some are forward to take oaths from a contempt of religion; others, from an extraordinary awe of the Divine Majesty, carry their fear to an unreasonable superstition; so make an equitable decision of a judge necessary." "No man will perjure himself (says Aristotle) who apprehends vengeance from Heaven and disgrace among men." Clinias was so very scrupulous, that rather than take an oath (though lawfully), he suffered the loss of three talents. Perjury, in the time of Philo Judeus, was abominated and capitally punished among the Jews; though since they have much degenerated, having been poisoned with the books of the Talmud, which says, "He who breaks his promissory oath, or any vows he enters into by the year, if he has a mind that they should be ineffectual and invalid, let him rise the last day of the year, and say, Whatever promises, oaths, and vows I may think fit to make in the year following, let them be null, void, and of no effect." Tract. iii. part 3. of the *Talmud*, in the treatise *Nedharim*, ch. 4. And the modern Jews use the same artifice, thinking they may then lawfully deceive the Christians. See *Hieron. ex Dictis Talmud*, c. 3. and *Magister Joannes de Concor. Legum*, tit. iv. c. 7.

In our law, no notice is taken of any perjury but such as is committed in some court of justice having power to administer an oath; or before some magistrate or proper officer invested with a similar authority, in some proceedings relative to a civil suit or a criminal prosecution: for it esteems all other oaths unnecessary at least, and therefore will not punish the breach of them. For which reason it is much to be questioned, how far any magistrate is justifiable in taking a voluntary affidavit in any extrajudicial matter, as is now too frequent upon every petty occasion; since it is more than possible that, by such idle oaths, a man may frequently, *in foro conscientiæ*, incur the guilt, and at the same time evade the temporal penalties of perjury. The perjury must also be corrupt (that is, committed *malo animo*), wilful, positive, and absolute; not upon surprise, or the like: it also must be in some point material to the question in dispute; for if it only be in some trifling collateral circumstance, to which no regard is paid, it is no more penal than in the voluntary extrajudicial oaths before mentioned. Subornation of perjury is the offence of procuring another to take such a false oath as constitutes perjury in the principal. The punishment of perjury and subornation, at common law, has been various. It was anciently death; afterwards banishment, or cutting out the tongue; then forfeiture of goods; and now it is fine and imprisonment, and never more to be capable of bearing testimony. But the statute 5 Eliz. c. 9. (if the offender be prosecuted thereon) inflicts the penalty of perpetual infamy, and a fine of 40l. on the suborner; and in default of payment, imprisonment for six months, and to stand with both ears nailed to the pillory. Perjury itself is thereby punished with six months imprisonment, perpetual infamy, and a fine of 20l. or to have both ears nailed to the pillory. But the prosecution is usually carried on for the offence at common law; especially as, to the penalties before inflicted, the statute 2 Geo. II. c. 25. superadds a power for the court to order the offender to be sent to the house of correction for a term not exceeding seven years, or to be transported for the same period; and makes it felony, without benefit of clergy, to return or escape within the time. It has sometimes been wished, that perjury, at least upon capital accusations, whereby another's life has been or might have been destroyed, was also rendered capital, upon a principle of retaliation; as it was universally by the laws of France. And certainly the odiousness of the crime pleads strongly in behalf of the French law. But it is to be considered, that they admitted witnesses to be heard only on the side of the prosecution, and used the rack to extort a confession from the accused. In such a constitution, therefore, it was necessary to throw the dread of capital punishment into the other scale, in order to keep in awe the witnesses for the crown; on whom alone the prisoner's fate depended; so naturally does one cruel law beget another. But corporal and pecuniary punishments, exile, and perpetual infamy, are more suited to the genius of the English law; where the fact is openly discussed between witnesses on both sides, and the evidence for the crown may be contradicted and disproved by those of the prisoner. Where indeed the death of an innocent person has actually been the consequence of such wilful perjury, it falls within the guilt of deliberate murder, and deserves an equal punishment; which our ancient law in fact inflicted. But the mere attempt to destroy life by other means not being capital, there is no reason that an attempt by perjury should; much less that this crime should, in all judicial cases, be punished with death. For to multiply capital punishments lessens their effect, when applied to crimes of the deepest dye; and, detestable as perjury is, it is not by any means to be compared with some other offences, for which only death can be inflicted; and therefore it seems already (except perhaps in the instance of deliberate murder by perjury) very properly punished by our present law; which has adopted the opinion of Cicero, derived from the law of the twelve tables, *Perjurii pœna divina, exitium; humana, dedecus*. See OATH.

PERIWIG. See PERRUKE.

PERIZONIUS, JAMES, a learned and laborious writer, was born at Dam in 1651. He became professor of history and eloquence at the university of Franeker, when, by his merit and learning, he made that university flourish. However, in 1693, he went to Leyden, where he was made professor of history, eloquence, and the Greek tongue; in which employment he continued till his death, which happened in 1715. He wrote many Dissertations, and other learned and curious works, particularly *Origines Babylonicæ et Egyptiacæ*, 2 vols. 8vo, &c. But the part of his labours which is the most generally known, and perhaps the most useful, is the notes which he wrote upon *Sanctii Minerva*. That work, as published by Perizonius, certainly suggested the idea of Harris's Hermes; and we hesitate not to say, that our countryman has made hardly any improvement on the system of his master.

PERIZZITES, the ancient inhabitants of Palestine, mingled with the Canaanites. There is also great probability that they themselves were Canaanites; but having no fixed habitations, sometimes dispersed in one country and sometimes in another, they were for that reason called *Perizzites*, which signifies *scattered* or *dispersed*. *Pherazoth* stands for *hamlets* or *villages*. The Perizzites did not inhabit any certain portion of the land of Canaan; there were some of them on both sides the river Jordan, in the mountains, and in the plains. In several places of Scripture the Canaanites and Perizzites are mentioned as the two chief people of the country. It is said, for example, that in the time of Abraham and Lot the Canaanite and Perizzite were in the land (Gen. xiii. 7.). The Israelites of the tribe of Ephraim complained to Joshua that they were too much pent up in their possession (Josh. xvii. 15.): he bid them go, if they pleased, into the mountains of the Perizzites, and Rephaims or giants, and there clearing the land, to cultivate and inhabit it. Solomon subdued the remains of the Canaanites and Perizzites which the children of Israel had not rooted out, and made them tributary to him (1 Kings ix. 20, 21. and 2 Chr. viii. 7.). There is still mention made of the Perizzites in the time of Ezra (ix. 1.), after the return from the captivity of Babylon; and several Israelites had married wives from that nation.

PERKIN, a beverage prepared from pears. See CYDERKIN, under AGRICULTURE, N° 656.

PERMEABLE, a term applied to bodies of so loose a texture as to let something pass through them.

PERMSKI, or PERMIA, a town of the Russian empire, and capital of a province of the same name, seated on the river Kama between the Dwina and the Oby; E. Long. 55. 50. N. Lat. 57. 10.

PERMUTATION, in commerce, the same with bartering. In the canon-law, permutation denotes the actual exchange of one benefice for another.

PERNAMBUCO, a province of Brazil, in South America, bounded on the north and east by the ocean, on the south by Bahia, and on the west by Piara. It is about 300 miles in length and as much in breadth. The Dutch became masters of it in 1630, but the Portuguese soon after retook it. It produces a great quantity of sugar, cotton, and Brazil wood. An insurrection broke out in this province on the 7th April 1817. The Portuguese authorities were driven out, and a republican constitution proclaimed; but in the following month the revolutionists were subdued.

PERNIO, a kibe or chilblain, is a little ulcer, occasioned by cold, in the hands, feet, heels, nose, and lips. It will come on when warm parts are too suddenly exposed to cold, or when parts from being too cold are suddenly exposed to a considerable warmth; and has always a tendency to gangrene, in which it frequently terminates. It most commonly attacks children of a sanguine habit and delicate constitution; and may be prevented or removed by such remedies as invigorate the system, and are capable of removing any tendency to gangrene in the constitution.

PERONÆUS, in *Anatomy*, is an epithet applied to some of the muscles of the perone or fibula. See ANATOMY, *Table of the Muscles*.

PERONES, a sort of high shoes which were worn not only by country people, but by men of ordinary rank at Rome. In the early times of the commonwealth they were worn even by senators; but at last they were disused by persons of figure, and confined to ploughmen and labourers. They were very rudely formed, consisting only of hides undressed, and reaching to the middle of the leg. Virgil mentions the perones as worn by a company of rustic soldiers on one foot only.

PERONNE, a strong town of France, in the department of Somme. It is said never to have been taken, though often besieged. It is seated on the Somme. E. Long. 3. 1. N. Lat. 44. 50. Population 3700 in 1800.

PERORATION, in *Rhetoric*, the epilogue or last part of an oration, wherein what the orator had insisted on through his whole discourse is urged afresh with greater vehemence and passion. The peroration consists of two parts. 1. Recapitulation; wherein the substance of what was diffused throughout the whole speech is collected briefly and cursorily, and summed up with new force and weight. 2. The moving the passions; which is so peculiar to the peroration, that the masters of the art call this part *sedes affectuum*. The passions to be raised are various, according to the various kinds of oration. In a panegyric, love, admiration, emulation, joy, &c. In an invective, hatred, contempt, &c. In a deliberation, hope, confidence, or fear. The qualities required in the peroration are, that it be very vehement and passionate, and that it be short; because, as Cicero observes, tears soon dry up. These qualities were well observed by Cicero, who never had an equal in the management of this part of an orator's province; for peroration was his master-piece.

"Concerning peroration (says Dr Blair), it needless to say much, because it must vary so considerably, according to the strain of the preceding discourse. Sometimes the whole pathetic part comes in most properly at the peroration. Sometimes, when the discourse has been entirely argumentative, it is fit to conclude with summing up the arguments, placing them in one view, and leaving the impression of them full and strong on the mind of the audience. For the great rule of a conclusion, and what nature obviously suggests, is, to place that last on which we choose that the strength of our case should rest.

"In all discourses, it is a matter of importance to hit the precise time of concluding, so as to bring our discourse just to a point; neither ending abruptly and unexpectedly, nor disappointing the expectation of the hearers when they look for the close, and continuing to hover round and round the conclusion till they become heartily tired of us. We should endeavour to get off with a good grace; not to end with a languishing and drawling sentence, but to close with dignity and spirit, that we may leave the minds of the hearers warm, and dismiss them with a favourable impression of the subject and of the speaker."

PEROTIS, a genus of plants belonging to the triandria class, and in the natural method ranking under the 4th order, *Gramina*. See BOTANY *Index*.

PERPENDICULAR, in *Geometry*, a line falling directly on another line, so as to make equal angles on each side. See GEOMETRY.

PERPETUAL, something that endures always, or lasts for ever.

PERPETUAL Motion. See MOVEMENT.

PERPIGNAN, a considerable town of Rousillon, in France, with a strong citadel, an university, and a bishop's see. It is seated on the river Tet; over which there is a handsome bridge. E. Long. 0. 43. N. Lat. 45. 18.

PERQUISITE, in a general sense, something gained by a place over and above settled wages.

PERQUISITE, in *Law*, is any thing gotten by a man's own industry, or purchased with his money; in contradistinction to what descends to him from his father or other ancestor.

PERRAULT, Claude, the son of an advocate in parliament, was born at Paris in 1613; and was bred a physician, though he never practised but among his relations, friends, and the poor. He discovered early a particular taste for the sciences and fine arts; of which he acquired a consummate knowledge without the assistance of a master: he excelled in architecture, painting, sculpture, mathematics, physics, and all those arts that relate to designing and mechanics. The entrance into the Louvre, which was designed by him, is, according to the judgment of Voltaire, one of the most august monuments of architecture in the world. M. Colbert put him upon translating Vitruvius into French; which he performed, and published it in 1673, folio, with figures from his own drawings; which are said to have been more exactly finished than the plates themselves. When the academy of sciences was established, he was one of its first members, and was chiefly depended on for mechanics and natural philosophy. His works are, *Memoires pour servir à l'Histoire naturelle des Animaux*, folio, 1676, with figures; *Essais de Physique*, 4 vols. 12mo, 1688; *Recueil des plusieurs machines de nouvelle invention*, 4to, 1700, &c. He died in 1688.

Perrault, *Charles*, the brother of Claude, was born at Paris in 1626, with as great a genius for arts, and a greater for letters, than his brother. Colbert chose him first clerk of the buildings, of which he was superintendant, and afterward made him comptroller general of the finances under him. He was one of the first members of the academy of the belles lettres and inscriptions, and was received into the French academy in 1671. His poem, *La Peinture*, printed in 1688, was universally admired: that entitled *La siecle de Louis le Grand*, in which he exalted the modern authors above the ancient, was a prelude to a war with all the learned. After he had disengaged himself from this contest, he applied himself to draw up eulogies of several great men of the 17th century, with their portraits, of which he has collected 102. There are other esteemed works of Perrault.—Besides these there were two other brothers, *Peter* and *Nicholas*, who made themselves known in the literary world.

PERRON, James Davy du, a cardinal, distinguished by his abilities and learning, was born in the canton of Bern in 1556. He was educated by Julian Davy, his father, a learned Calvinist, who taught him Latin and the mathematics; after which, he by himself became acquainted with the Greek and Hebrew, philosophy, and the poets. Philip Desportes, abbot of Tyron, made him known to Henry III. king of France, who conceived a great esteem for him. Some time after, Du Perron abjured Calvinism, and afterwards embraced the ecclesiastical function; and having given great proofs of his wit and learning, he was chosen to pronounce the funeral oration of Mary queen of Scots. After the murder of Henry III. he retired to the house of Cardinal de Bourbon, and took great pains in bringing back the Protestants to the church of Rome. Among others he gained over Henry Spondanus, afterwards bishop of Pamiers. He also chiefly contributed to engage Henry IV. to change his religion; and that prince sent him to negociate his reconciliation to the holy see, to which he succeeded. Du Perron was consecrated bishop of Evreaux while he resided at Rome. On his return to France, he wrote, preached, and disputed against the reformed; particularly against Du Plessis Mornay, with whom he had a public conference in the presence of the king at Fountainbleau. He was made cardinal in 1604 by Pope Clement VIII. at the solicitation of Henry IV. who afterwards nominated him to the archbishopric of Sens. The king at length sent him to Rome with Cardinal Joyeuse, in order to terminate the disputes which had arisen between Paul V. and the Venetians. It is said that this pope had such a high opinion of the address of the cardinal Du Perron, that he used to say, "Let us pray to God to inspire the cardinal Du Perron, for he will persuade us to do whatever he pleases." After the death of Henry IV. he retired into the country, where he put the last hand to his work; and, setting up a printing-house, corrected every sheet himself. He died at Paris in 1618. His works were collected after his death, and published at Paris in 3 vols. folio.

PERROT, Nicholas, Sieur d'Ablancourt, one of the first geniuses of his age, was born at Chalons in 1606. After studying philosophy about three years, he was sent to Paris to follow the law. At eighteen years of age he was admitted advocate of parliament, and frequented the bar; but he soon conceived a distaste for it, and therefore discontinued his practice. This displeased an uncle, but whose favour he recovered by quitting the Protestant religion. He could not, however, be prevailed upon to take orders in the Romish church; and some years after, he had a desire to return to the religion he had abjured. But, that he might not do any thing rashly, he resolved to study philosophy and divinity. For that purpose he chose for his master Mr Stuart a Scotsman and Lutheran, a man of great learning. Almost three years he spent in the most assiduous study; and then set out from Paris to Champagne, where he abjured the Roman Catholic, and once more embraced the Protestant religion. In 1637 he was admitted a member of the French academy; a little after which he undertook a translation of Tacitus. Whilst he was engaged in that laborious task, he retired to his small estate of Ablancourt, and lived there till his death in 1664. He was a man of fine understanding, of great piety and integrity, and of universal learning. Moreri has given a catalogue of his works, the greatest part of which consist of translations, which seemed rather originals.

PERRUKE, Peruke, or *Periwig*, was anciently a name for a long head of natural hair; such, particularly, as there was care taken in the adjusting and trimming of. Menage derives the word rather fancifully from the Latin, *pilus*, "hair." It is derived, according to this critic, thus, *pilus*, *pelus*, *pelutus*, *peluticus*, *pelutica*, *perutica*, *peruca*, *perruque*. The Latins called it *coma;* whence part of Gaul took the denomination of *Gallia Comata*, from the long hair which the inhabitants wore as a sign of freedom. An ancient author says, that Absalom's perruke weighed 200 shekels.

The word is now used for a set of false hair, curled, buckled, and sewed together on a frame or cawl; an-

Perruke, Perry.

ciently called *capillamentum* or "false perruke." It is doubted whether or not the use of perrukes of this kind was known among the ancients. It is true, they used false hair: Martial and Juvenal make merry with the women of their time, for making themselves look young with their borrowed hair; with the men who changed their colours according to the seasons; and with the dotards, who hoped to deceive the Destinies by their white hair. But these seem to have scarce had any thing in common with our perrukes; and were at best only composed of hair painted, and glued together. Nothing can be more ridiculous than the description Lampridius gives of the emperor Commodus's perruke: it was powdered with scrapings of gold, and oiled (if we may use the expression) with glutinous perfumes for the powder to hang by. In effect, the use of perrukes, at least in their present mode, is not much more than 160 years old; the year 1629 is reckoned the epocha of long perrukes, at which time they began to appear in Paris; from whence they spread by degrees through the rest of Europe. At first it was reputed a scandal for young people to wear them, because the loss of their hair at that age was attributed to a disease the very name whereof is a reproach; but at length the mode prevailed over the scruple, and persons of all ages and conditions have worn them, foregoing without any necessity the conveniences of their natural hair. It was, however, some time before the ecclesiastics came into the fashion: the first who assumed the perruke were some of the French clergy, in the year 1660; nor is the practice yet well authorized. Cardinal Grimaldi in 1684, and the bishop of Lavaur in 1688, prohibited the use of the perruke to all priests without a dispensation or necessity. M. Thiers has an express treatise, to prove the perruke indecent in an ecclesiastic, and directly contrary to the decrees and canons of councils. A priest's head, embellished with artificial hair curiously adjusted, he esteems a monster in the church; nor can he conceive any thing so scandalous as an abbot with a florid countenance, heightened with a well-curled perruke.

PERRY, CAPTAIN JOHN, was a famous engineer, who resided long in Russia, having been recommended to the czar Peter while in England, as a person capable of serving him on a variety of occasions relating to his new design of establishing a fleet, making his rivers navigable, &c. His salary in this service was 300l. per annum, besides travelling expences and subsistence money on whatever service he should be employed, together with a further reward to his satisfaction at the conclusion of any work he should finish. After some conversation with the czar himself, particularly respecting a communication between the rivers Volga and Don, he was employed on that work for three summers successively; but not being well supplied with men, partly on account of the ill success of the czar's arms against the Swedes at the battle of Narva, and partly by the discouragement of the governor of Astracan, he was ordered at the end of 1707 to stop, and next year was employed in refitting the ships at Veronise, and 1700 in making the river of that name navigable; but after repeated disappointments, and a variety of fruitless applications for his salary, he at last quitted the kingdom under the protection of Mr Whitworth, the English ambassador, in 1712: (See his narrative in the Preface to *The State of Russia*). In 1721 he was employed in stopping with success the breach at Dagenham, in which several other undertakers had failed; and the same year about the harbour at Dublin, to the objections against which he then published an Answer. He was author of The State of Russia, 1716, 8vo, and an account of the stopping of Dagenham Breach, 1721, 8vo; and died February 11. 1733.

PERRY, the name of a very pleasant and wholesome liquor extracted from pears, in the same manner as cyder is from apples. See CYDER, and AGRICULTURE *Index*.

The best pears for perry, or at least the sorts which have been hitherto deemed the fittest for making this liquor, are of a tart and harsh quality. Of these the Bosbury pear, the Bareland pear, and the horse pear, are the most esteemed for perry in Worcestershire, and the squash pear, as it is called, in Gloucestershire; in both which counties, as well as in some of the adjacent parts, they are planted in the hedge-rows and most common fields. There is this advantage attending pear-trees, that they will thrive on land where apples will not so much as live, and that some of them grow to such a size, that a single pear-tree, particularly of the Bosbury and the squash kind, has frequently been known to yield, in one season, from one to four hogsheads of perry. The Bosbury pear is thought to yield the most lasting and most vinous liquor. The John pear, the Harpary pear, the Drake pear, the Mary pear, the Lullum pear, and several others of the harshest kinds, are esteemed the best for perry, but the redder or more tawney they are, the more they are preferred. Pears as well as apples, should be full ripe before they are ground.

Dr Beale, in his general advertisements concerning cyder, subjoined to Mr Evelyn's Pomona, disapproves of Palladius's saying, that perry will keep during the winter, but that it turns sour as soon as the weather begins to warm; and gives, as his reasons for being of a contrary opinion, that he had himself tasted at the end of summer, a very brisk, lively, and vinous liquor, made of horse pears; that he had often tried the juice of the Bosbury pear, and found it both pleasanter and richer the second year, and still more so the third, though kept only in common hogsheads, and in but indifferent cellars, without being bottled; and that a very honest, worthy, and ingenious gentleman in his neighbourhood, assured him, as of his own experience, that it will keep a great while, and grow much the stronger for keeping, if put into a good cellar and managed with due care. He imputes Palladius's error to his possibly speaking of common eatable pears, and to the perry's having been made in a very hot country: but he would have ascribed it to a more real cause, perhaps, had he pointed out the want of a thorough regular fermentation, to which it appears plainly that the ancients were entire strangers; for all their vinous liquors were medicated by boiling before they were laid up in order to be kept.

PERSECUTION, is any pain or affliction which a person designedly inflicts upon another; and in a more restrained sense, the sufferings of Christians on account of their religion.

Historians usually reckon ten general persecutions, the first of which was under the emperor Nero, 31 years after our Lord's ascension; when that emperor having set fire to the city of Rome, threw the odium of that execrable action on the Christians, who under that pretence were wrapped up in the skins of wild beasts, and worried and devoured by dogs; others were crucified, and others burnt alive. The second was under Domitian, in the year 95. In this persecution St John the apostle was sent to the isle of Patmos, in order to be employed in digging in the mines. The third began in the third year of Trajan, in the year 100, and was carried on with great violence for several years. The fourth was under Antoninus the philosopher, when the Christians were banished from their houses, forbidden to show their heads, reproached, beaten, hurried from place to place, plundered, imprisoned, and stoned. The fifth began in the year 197, under the emperor Severus. The sixth began with the reign of the emperor Maximinus in 235. The seventh, which was the most dreadful persecution that had ever been known in the church, began in the year 250, in the reign of the emperor Decius, when the Christians were in all places driven from their habitations, stripped of their estates, tormented with racks, &c. The eighth began in the year 257, in the fourth year of the reign of the emperor Valerian. The ninth was under the emperor Aurelian, A. D. 284; but this was very inconsiderable: and the tenth began in the 19th year of Dioclesian, A. D. 303. In this dreadful persecution, which lasted ten years, houses filled with Christians were set on fire, and whole droves were tied together with ropes and thrown into the sea. See TOLERATION.

PERSEES, the descendants of a colony of ancient Persians, who took refuge at Bombay, Surat, and in the vicinity of those cities, when their own country was conquered 1100 years ago by the Mahometan Arabs. They are a gentle, quiet, and industrious people, loved by the Hindoos, and living in great harmony among themselves. The consequence is, that they multiply exceedingly, whilst their countrymen in the province of Kerman are visibly diminishing under the yoke of the Mahometan Persians. Of the manners and customs of this amiable race, we have the following account in Heron's elegant translation of Niebuhr's Travels.

"The Persees (says he) make common contributions for the aid of their poor, and suffer none of their number to ask alms from people of a different religion. They are equally ready to employ their money and credit to screen a brother of their fraternity from the abuses of justice. When a Persee behaves ill, he is expelled from their communion. They apply to trade, and exercise all sorts of professions.

"The Persees have as little knowledge of circumcision as the Hindoos. Among them, a man marries only one wife, nor ever takes a second, unless when the first happens to be barren. They give their children in marriage at six years of age; but the young couple continue to live separate, in the houses of their parents, till they attain the age of puberty. Their dress is the same as that of the Hindoos, except that they wear under each ear a tuft of hair, like the modern Persians. They are much addicted to astrology, although very little skilled in astronomy.

"They retain the singular custom of exposing their dead to be eaten by birds of prey, instead of interring or burning them. I saw (continues our author) on a hill at Bombay a round tower, covered with planks of wood, on which the Persees lay out their dead bodies. When the flesh is devoured, they remove the bones into two chambers at the bottom of the tower.

"The Persees, followers of the religion of Zerdust or Zoroaster, adore one God only, eternal and almighty. They pay, however, a certain worship to the sun, the moon, the stars, and to fire, as visible images of the invisible divinity. Their veneration for the element of fire induces them to keep a sacred fire constantly burning, which they feed with odoriferous wood, both in the temples, and in the houses of private persons who are in easy circumstances. In one of their temples at Bombay, I saw a fire which had burnt unextinguished for two centuries. They never blow out a light, lest their breath should soil the purity of the fire. See POLYTHEISM.

"The religion of the Persees enjoins purifications as strictly as that of the Hindoos. The disciples of Zerdust are not, however, obliged to abstain from animal food. They have accustomed themselves to refrain from the flesh of the ox, because their ancestors promised the Indian prince who received them into his dominions never to kill horned cattle. This promise they continue to observe under the dominion of Christians and Mahometans. The horse is by them considered as the most impure of all animals, and regarded with extreme aversion.

"Their festivals, denominated *Ghumbars*, which return frequently, and last upon each occasion five days, are all commemorations of some part of the work of creation. They celebrate them not with splendour, or with any particular ceremonies, but only dress better during those five days, perform some acts of devotion in their houses, and visit their friends."

The Persees were till lately but very little known: the ancients speak of them but seldom, and what they say seems to be dictated by prejudice. On this account Dr Hyde, who thought the subject both curious and interesting, about the end of the 17th century attempted a deeper investigation of a subject which till then had been but very little attended to. He applied to the works of Arabian and Persian authors, from whom, and from the relations of travellers, together with a variety of letters from persons in India, he compiled his celebrated work on the religion of the Persees. Other accounts have been given by different men, as accident put information in their way. But the most distinguished is by M. Anquetil du Perron, who undertook a voyage to discover and translate the works attributed to Zoroaster. Of this voyage he drew up an account himself, and read it before the Royal Academy of Sciences at Paris in May 1761. A translation of it was made and published in the Gentleman's Magazine for 1762, to which we refer our readers. The account begins at page 373, and is concluded at page 614. Remarks were afterwards made on Du Perron's account by a Mr Yates. See the same Magazine for 1766, p. 529.

PERSEPOLIS, formerly the capital of Persia, situated in N. Lat. 30. 30. E. Long. 84. 0. now in ruins, but remarkable for the most magnificent remains of a palace or temple that are to be found throughout the world.—This city stood in one of the finest plains in Persia, being 18 or 19 leagues in length, and in some places

Plate CCCCIX.

places two, in some four, and in others six leagues in breadth. It is watered by the great river Araxes, now Bendemir, and by a multitude of rivulets besides. Within the compass of this plain, there are between 1000 and 1500 villages, without reckoning those in the mountains, all adorned with pleasant gardens, and planted with shady trees. The entrance of this plain on the west side has received as much grandeur from nature, as the city it covers could do from industry or art. It consists of a range of mountains steep and high, four leagues in length, and about two miles broad, forming two flat banks, with a rising terrace in the middle, the summit of which is perfectly plain and even, all of native rock. In this there are such openings, and the terraces are so fine and so even, that one would be tempted to think the whole the work of art, if the great extent, and prodigious elevation thereof, did not convince one that it is a wonder too great for aught but nature to produce. Undoubtedly these banks were the very place where the advanced guards from Persepolis took post, and from which Alexander found it so difficult to dislodge them. One cannot from hence descry the ruins of the city, because the banks are too high to be overlooked; but one can perceive on every side the ruins of walls and of edifices, which heretofore adorned the range of mountains of which we are speaking. On the west and on the north this city is defended in the like manner: so that considering the height and evenness of these banks, one may safely say that there is not in the world a place so fortified by nature.

The mountain Rehumut, in the form of an amphitheatre, encircles the palace, which is one of the noblest and most beautiful pieces of architecture remaining of all antiquity. Authors and travellers have been exceedingly minute in their descriptions of those ruins; and yet some of them have expressed themselves so differently from others, that, had they not agreed with respect to the latitude and longitude of the place, one would be tempted to suspect that they had visited different ruins. These ruins have been described by Garcias de Silva Figueroa, Pietro de la Valle, Chardin, Le Brun, and Mr Francklin. We shall adopt the description of an intelligent traveller. The ascent to the columns is by a grand staircase of blue stone containing 104 steps.

"The first object that strikes the beholder on his entrance, are two portals of stone, about 50 feet in height each; the sides are embellished with two sphinxes of an immense size, dressed out with a profusion of beadwork, and contrary to the usual method, they are represented standing. On the sides above are inscriptions in an ancient character, the meaning of which no one hitherto has been able to decypher.

"At a small distance from these portals you ascend another flight of steps, which lead to the grand hall of columns. The sides of this staircase are ornamented with a variety of figures in basso relievo; most of them have vessels in their hands: here and there a camel appears, and at other times a kind of triumphal car, made after the Roman fashion; besides these are several led horses, oxen, and rams, that at times intervene and diversify the procession. At the head of the staircase is another basso relievo, representing a lion seizing a bull; and close to this are other inscriptions in ancient characters. On getting to the top of this staircase, you enter what was formerly a most magnificent hall: the natives have given this the name o *chehul minar*, or forty pillars; and though this name i often used to express the whole of the building, it i more particularly appropriated to this part of it. Although a vast number of ages have elapsed since th foundation, 15 of the columns yet remain entire; the are from 70 to 80 feet in height, and are masterly piece of masonry: their pedestals are curiously worked, an appear little injured by the hand of time. The shaft are enfluted up to the top, and the capitals are adorne with a profusion of fretwork.

"From this hall you proceed along eastward, unti you arrive at the remains of a large square building, t which you enter through a door of granite. Most c the doors and windows of this apartment are still standing; they are of black marble, and polished like mirror: on the sides of the doors, at the entrance, a bas-reliefs of two figures at full length; they represen a man in the attitude of stabbing a goat: with on hand he seizes hold of the animal by the horn, an thrusts a dagger into his belly with the other; one the goat's feet rests upon the breast of the man, an the other upon his right arm. This device is commo throughout the palace. Over another door of the sam apartment is a representation of two men at full length behind them stands a domestic holding a spread umbrella: they are supported by large round staffs, appear to be in years, have long beards, and a profusion hair upon their heads.

"At the south-west entrance of this apartment a two large pillars of stone, upon which are carved fo figures; they are dressed in long garments, and hold i their hands spears 10 feet in length. At this entranc also the remains of a staircase of blue stone are still visible. Vast numbers of broken pieces of pillars, shaft and capitals, are scattered over a considerable extent ground, some of them of such enormous size, that it wonderful to think how they could have been brough whole, and set up together. Indeed, every remains these noble ruins indicate their former grandeur an magnificence, truly worthy of being the residence of great and powerful monarch."

These noble ruins are now the shelter of beasts an birds of prey. Besides the inscriptions above mentioned, there are others in Arabic, Persian, and Greek. D Hyde observes, that the inscriptions are very rude an clumsy; and that some, if not all of them, are in prai of Alexander the Great; and therefore are later tha that conqueror. See the article RUINS.

PERSEVERANCE, in *Theology*, a continuance i a state of grace to a state of glory.

About this subject there has been much controvers in the Christian church. All divines, except Unitarians, admit, that no man can be ever in a state of grac without the co-operation of the spirit of God; but th Calvinists and Arminians differ widely as to the natur of this co-operation. The former, at least such as ca themselves the *true disciples of Calvin*, believe, that thos who are once under the influence of divine grace ca never fall totally from it, or die in mortal sin. Th Arminians, on the other hand, contend, that the whol of this life is a state of probation; that without th grace of God we can do nothing that is good; that th Holy Spirit assists, but does not overpower, our natura faculties; and that a man, at any period of his life, may resist, grieve, and even quench, the spirit. See THEOLOGY.

PERSEUS was the most ancient of all the Greek heroes. He founded the city of Mycenæ, of which he became afterwards king, and where he and his posterity reigned for 100 years. He flourished, according to most chronologists, 1348, B. C.; but, according to Sir Isaac Newton, only 1028.

PERSEUS. See ASTRONOMY *Index*.

PERSIA,

Extent of Persia.

A MOST ancient and celebrated empire of Asia, extending in length from the mouth of the river Araxes to that of the river Indus, about 1840 of our miles, and in breadth from the river Oxus, to the Persian gulf, about 1080 of the same miles. It is bounded on the north by the Caspian sea, the river Oxus, and Mount Caucasus; on the east, by the river Indus and the dominions of the Great Mogul; on the south, by the Persian gulf and the Indian ocean; and on the west, by the dominions of the Grand Signior.

2 Persia properly the name of only one province of this vast empire.

We learn from Sir William Jones, the illustrious president of the Asiatic Society, that Persia is the name of only one province of this extensive empire, which by the present natives, and all the learned *Mussulmans* who reside in the British territories in India, is called *Irân*. It has been a practice not uncommon in all ages to denominate the whole of a country from that part of it with which we are best acquainted; and hence have the Europeans agreed to call Irân by the name of that province of which Shirauz is the capital: See SHIRAUZ.

3 Various names of the country.

The most ancient name, however, of this country was that of *Elam*, or, as some write it *Ælam*, from Elam the son of Shem, from whom its first inhabitants are descended. Herodotus calls its inhabitants *Cephenes*; and in very ancient times the people are said to have called themselves *Artæi*, and the country where they dwelt *Artæa*. In the books of Daniel, Esdras, &c. it is called by the names of *Pars*, *Pharas*, or *Fars*, whence the modern name of *Persia*; but whence those names have been derived, is now uncertain.

4 Opinions respecting its first population.

That Persia was originally peopled by Elam the son of Shem, has been very generally admitted; but the truth is, that of the ancient history of this distinguished empire very little is perfectly known. For this ignorance, which at first seems strange, satisfactory reasons may easily be assigned; of which the principal are the superficial knowledge of the *Greeks* and *Jews*, and the loss of Persian archives or historical compositions. "That the Grecian writers before XENOPHON had *no* acquaintance with *Persia*, and that their accounts of it are wholly fabulous, is a paradox too extravagant to be seriously mentioned; but (says Sir William Jones) their connection with it in war or peace had been generally confined to bordering kingdoms under feudatory princes; and the first *Persian* emperor, whose life and character they seem to have known with tolerable accuracy, was the great CYRUS." Our learned author, however, is so far from considering Cyrus as the first Persian monarch, that he thinks it evident a powerful monarchy had subsisted in Irân for ages before the accession of that hero; that this monarchy was called the *Mahébédian* dynasty; and that it was in fact the oldest monarchy in the world. The evidence upon which the president rests this opinion, is the work of a Mahometan traveller, compiled from the books of such Persians as fled from their country upon the innovation in religion made by Zoroaster: and if these books, of which a few still remain, be genuine, and the Mahometan a faithful compiler, facts of which Sir William has not the smallest doubt, the evidence is certainly sufficient to bear the superstructure which he has raised upon it.

5 Perhaps the original seat of the human race.

If the Persian monarchy was thus ancient, it is natural to suppose that Persia or Irân was the original seat of the human race, whence colonies were sent out or emigrated of themselves to people the rest of the habitable globe. This supposition is actually made by our ingenious author, who strongly confirms it by remarks on the most ancient language of Persia, which he shows to have been the parent of the *Sanscrit*, as well as of the Greek, Latin, and Gothic (see PHILOLOGY). He therefore holds, as a proposition firmly established, "that *Irân* or Persia, in its largest sense, was the true centre of population, of knowledge, of languages, and of arts; which instead of travelling westward only, as it has been fancifully supposed, or eastward, as might with equal reason have been asserted, were expanded in all directions to all the regions of the world." He thinks it is from good authority that the Saxon Chronicle brings the first inhabitants of Britain from Armenia; that the Goths have been concluded to come from Persia; and that both the Irish and old Britons have been supposed to have proceeded from the borders of the Caspian: for all these places were comprehended within the ancient Irân.

6 Accounts of the birth, &c. of Cyrus.

Of this first Persian monarchy we have no historical accounts; and must therefore, after having thus mentioned it, descend at once to the era of Cyrus. This prince is celebrated both by sacred and profane historians; but the latter are at no small variance concerning his birth and accession to the throne. According to Herodotus, Astyages, the last king of the Medes, being warned in a dream, that the son who was to be born of his daughter Mandane, should one day be lord of Asia, resolved to marry her, not to a Mede, but to a Persian. Accordingly he chose for her husband one Cambyses, a man of a peaceable disposition, and of no very high station. However, about a year after they were married, Astyages was frightened by another dream, which made him resolve to dispatch the infant as soon as it should be born. Hereupon the king sent for his daughter, and put her under confinement, where she was soon after delivered of a son. The infant was committed to the care of one Harpagus, with strict orders to destroy it in what manner he thought proper. But he, having acquainted his wife with the command he had received, by her advice gave it to a shepherd, desiring him to let it perish by exposing it. But the shepherd, out of compassion, exposed a still-born child which his wife happened to be then delivered of, and brought up the son of Mandane as his own, giving him the name of CYRUS.

When the young prince had attained the age of ten years, as he was one day at play with other children of the same age, he was chosen king by his companions; and having, in virtue of that dignity, divided them into several orders and classes, the son of Artembares, a lord of eminent dignity among the Medes, refused to obey his orders; whereupon Cyrus caused him to be seized, and whipped very severely. The boy ran crying to his father; and he immediately hastened to the king's palace, loudly complaining of the affront his son had received from the son of a slave, and intreating Astyages to revenge, by some exemplary punishment, the indignity offered to him and his family. Astyages, commanding both the herdsman and his son to be brought before him, asked the latter, how he, who was the son of so mean a man, had dared to abuse the son of one of the chief lords of the kingdom? Cyrus replied, that he had done no more than he had a right to do; for the boys of the neighbourhood having chosen him king, because they thought him most worthy of that dignity, and performed what he, vested with that character, had commanded, the son of Artembares alone had slighted his orders, and for his disobedience had suffered the punishment he deserved. In the course of this conversation Astyages happening to recollect, that his grandson, whom he had ordered to be destroyed, would have been about the same age with Cyrus, began to question the shepherd concerning his supposed son, and at last obtained from him a confession of the whole truth.

Astyages having now discovered Cyrus to be his grandson, sent for Harpagus, who also confessed that he had not seen Mandane's son destroyed, but had given him to the shepherd; at which Astyages was so much incensed, that, having invited Harpagus to an entertainment, he caused him to be served with the flesh of his own son. When he had done, the king asked him whether he liked his victuals; and Harpagus answering, that he had never tasted any thing more delicious, the officers appointed for that purpose brought in a basket, containing the head, hands, and feet of his son, desiring him to uncover the basket, and take what he liked best. He did as they desired, and beheld the mangled remains of his only child without betraying the least concern, so great was the command which he had over his passions. The king then asked him, whether he knew with what kind of meat he had been entertained. Harpagus replied, that he knew very well, and was always pleased with what his sovereign thought fit to ordain; and having thus replied, with a surprising temper he collected the mangled parts of his innocent son, and went home.

Astyages having thus vented his rage on Harpagus, began next to consult what he should do with Cyrus. The magi, however, eased him of his fears with regard to him, by assuring him, that as the boy had been once chosen king by his companions, the dream had been already verified, and that Cyrus never would reign in any other sense. The king, being well pleased with this answer, called Cyrus, and, owning how much he had been wanting in the affection which he ought to have had towards him, desired him to prepare for a journey into Persia, where he would find his father and mother in circumstances very different from those of the poor shepherd and his wife with whom he had hitherto lived. Cyrus, on his arrival at his father's house, was received with the greatest joy. When he grew up, he soon became popular on account of his extraordinary parts; till at last his friendship was courted by Harpagus, who had never forgot the cruel treatment he received from Astyages. By this means a conspiracy was formed against Astyages; who being overthrown in two successive engagements, was taken prisoner and confined for life.

The account given by Xenophon of the rise of Cyrus is much more consonant to Scripture; for he tells us, that Babylon was conquered by the united forces of the Medes and Persians. According to him, Cyrus was the son of Cambyses king of the Medes, and Mandane the daughter of Astyages king of Persia. He was born a year after his uncle Cyaxares, the brother of Mandane. He lived till the age of twelve with his parents in Persia, being educated after the manner of the country, and inured to fatigues and military exercises. At this age he was taken to the court of Astyages, where he resided four years; when the revolt of the Medes and Persians from the Babylonians happened, and which ended in the destruction of the Babylonish empire, as related under the article BABYLON.

7 His war with the Lydians.

While Cyrus was employed in the Babylonish war, before he attacked the metropolis itself, he reduced all the nations of Asia Minor. The most formidable of these were the Lydians, whose king Crœsus assembled a very numerous army, composed of all the other nations in that part of Asia, as well as of Egyptians, Greeks, and Thracians. Cyrus being informed of these vast preparations, augmented his forces to 196,000 men, and with them advanced against the enemy, who were assembled near the river Pactolus. After long marches, he came up with them at Thymbra, not far from Sardis, the capital of Lydia. Besides the horse and foot, which amounted to 196,000, as already observed, Cyrus had 300 chariots armed with scythes, each chariot drawn by four horses abreast, covered with trappings that were proof against all sorts of missive weapons: he had likewise a great number of chariots of a larger size, upon each of which was placed a tower about 18 or 20 feet high, and in each tower were lodged 20 archers. These towers were drawn by 16 oxen yoked abreast. There was moreover a considerable number of camels, each mounted by two Arabian archers, the one looking towards the head, and the other towards the hinder part of the camel. The army of Crœsus consisted of 420,000 men. The Egyptians, who alone were 120,000 in number, being the main strength of the army, were placed in the centre. Both armies were drawn up in an immense plain, which gave room for the extending of the wings on either side; and the design of Crœsus, upon which alone he founded his hopes of victory, was to surround and hem in the enemy's army.

8. The battle of Thymbra.

When the two armies were in sight of each other, Crœsus, observing how much his front exceeded that of Cyrus, made the centre halt, but commanded the two wings to advance, with a design to inclose the Persian army, and begin the attack on both sides at once. When the two detached bodies of the Lydian forces were sufficiently extended, Crœsus gave the signal to the main body, which marched up to the front of the Persian army, while the two wings attacked them in flank; so that Cyrus's army was hemmed in on all sides, and, as Xenophon expresses it, was inclosed like a small square drawn within a great one. This motion, however, did not at all alarm the Persian commander; but, giving his troops the signal to face about, he attacked in flank those forces that were going to fall upon his rear so vigorously, that he put them into great disorder. At the same time a squadron of camels was made to advance against the enemy's other wing, which consisted mostly of cavalry. The horses were so frightened at the approach of these animals, that most of them threw their riders, and trod them under foot; which occasioned great confusion. Then Artageses, an officer of great valour and experience, at the head of a small body of horse, charged them so briskly, that they could never afterwards rally; and at the same time the chariots, armed with scythes, being driven in among them, they were entirely routed. Both the enemy's wings being thus put to flight, Cyrus commanded his chief favourite Abradates to fall upon the centre with the large chariots above mentioned. The first ranks, consisting mostly of Lydians, not being able to stand so violent a charge, immediately gave way; but the Egyptians, being covered with their bucklers, and marching so close that the chariots had not room to penetrate their ranks, a great slaughter of the Persians ensued. Abradates himself was killed, his chariot overturned, and the greatest part of his men were cut in pieces. Upon his death, the Egyptians, advancing boldly, obliged the Persian infantry to give way, and drove them back quite to their engines. There they met with a new shower of darts and javelins from their machines; and at the same time the Persian rear advancing sword in hand, obliged their spearmen and archers to return to the charge. In the mean time Cyrus, having put to flight both the horse and foot on the left of the Egyptians, pushed on to the centre, where he had the misfortune to find his Persians again giving ground; and judging that the only way to stop the Egyptians, who were pursuing them, would be to attack them in the rear, he did so; and at the same time the Persian cavalry coming up to his assistance, the fight was renewed with great slaughter on both sides. Cyrus himself was in great danger; for his horse being killed under him, he fell among the midst of his enemies: but the Persians, alarmed at the danger of their general, threw themselves headlong on their opponents, rescued him, and made a terrible slaughter; till at last Cyrus, admiring the valour of the Egyptians, offered them honourable conditions: letting them know at the same time, that all their allies had abandoned them. They accepted the terms offered them; and having agreed with Cyrus that they should not be obliged to carry arms against Crœsus, they engaged in the service of the conqueror, and continued faithful to him ever after.

9
Sardis taken, and the Lydian empire overthrown.

The next morning Cyrus advanced towards Sardis, and Crœsus marched out to oppose him at the head of the Lydians only: for his allies had all abandoned him. Their strength consisted mostly in cavalry; which Cyrus being well apprised of, he ordered his camels to advance; by whom the horses were so frightened, that they became quite ungovernable. However, the Lydians dismounted, and for some time made a vigorous resistance on foot; but were at last driven into the city, which was taken two days after: and thus the Lydian empire was totally destroyed.

10
Reduces Babylon.

After the conquest of Sardis, Cyrus turned his arms against Babylon itself, which he reduced in the manner related under that article. Having settled the civil government of the conquered kingdoms, Cyrus took a review of all his forces, which he found to consist of 600,000 foot, 120,000 horse, and 2000 chariots armed with scythes. With these he extended his dominion all over the nations to the confines of Ethiopia, and to the Red sea; after which he continued to reign peaceably over his vast empire till his death, which happened about 529 before Christ. According to Xenophon, he died a natural death; but others tell us, that, having engaged in a war with the Scythians, he was by them overthrown and cut in pieces with his whole army, amounting to 200,000 men. But this is very improbable, seeing all authors agree that the tomb of Cyrus was extant at Pasargada in Persia in the time of Alexander the Great; which it could not have been if his body had remained in the possession of the Scythians, as these authors assert.

11
His death.

In the time of Cyrus, the Persian empire extended from the river Indus to the Ægean sea. On the north it was bounded by the Euxine and Caspian seas, and on the south by Ethiopia and Arabia. That monarch kept his residence for the seven cold months at Babylon, by reason of the warmth of that climate; three months in the spring he spent at Susa, and two at Ecbatan during the heat of summer. On his deathbed he appointed his son Cambyses to succeed him in the empire; and to his other son, Smerdis, he gave several considerable governments. The new monarch immediately set about the conquest of Egypt; which he accomplished in the manner related in the history of that country.

12
Cambyses conquers Egypt.

Having reduced Egypt, Cambyses next resolved to turn his arms against the Carthaginians, Hammonians, and Ethiopians. But he was obliged to drop the first of these enterprises, because the Phœnicians refused to supply him with ships against the Carthaginians, who were a Phœnician colony. However, he sent ambassadors into Ethiopia with a design to get intelligence of the state and strength of the country. But the Ethiopian monarch, being well apprised of the errand on which they came, treated them with great contempt. In return for the presents sent him by Cambyses, he sent his own bow; and advised the Persians to make war upon the Ethiopians when they could bend such a strong bow as easily as he did, and to thank the gods that the Ethiopians had no ambition to extend their dominions beyond their own country.

13
His unsuccessful expedition against Ethiopia and the Hammonians.

Cambyses was no sooner informed of this answer by his ambassadors than he flew into a violent passion; and ordered his army immediately to begin their march, without considering that they were neither furnished with provisions nor any other necessary. When he arrived at Thebes in Upper Egypt, he detached 50,000 men, with orders to destroy the temple of Jupiter Ammon: but all these perished in the desert; not a single person arriving either at the oracle, or returning to Thebes. The rest of the army, led by Cambyses himself, experienced incredible hardships; for not being provided with any necessaries, they had not marched a fifth part of the way when they were obliged to kill and eat their beasts of burthen. When these failed, the soldiers fed on grass and roots, as long as any could be found; and at last were reduced to the dreadful necessity of eating one another; every tenth man, on whom the lot fell, being condemned to serve as food for his companions. The king, however, obstinately persisted in his design; till, being apprehensive of the danger he himself was in, he retreated to Thebes, after having lost the greatest part of his army.

14
He murders his brother.

Cambyses was a man of a very cruel and suspicious temper, of which he gave many instances; and the following proved indirectly the cause of his death.—We have already observed that the king of Ethiopia sent his bow in return for the presents brought to him by the ambassadors of Cambyses. The only man in the Persian army who could bend this bow was Smerdis the king's brother; and this instance of his personal strength so alarmed the tyrant, that, without any crime alleged, he caused him to be murdered. This gave occasion to one Smerdis, a magian, who greatly resembled the other Smerdis in looks, to assume the name of the deceased prince, and to raise a rebellion against Cambyses who was generally hated for his cruelty; and this he could the more easily do, as the chief management of affairs had been committed to this Smerdis during the king's absence. Cambyses, on receiving the news of this revolt, immediately ordered his army to march, in order to suppress it; but as he was mounting his horse, his sword, slipping out of its scabbard, wounded him in the thigh. On this accident, he asked the name of the city where he was; and being told that it was Ecbatan, he said in the presence of all his attendants, "Fate has decreed that Cambyses the son of Cyrus shall die in this place." For, having consulted the oracle of Butus, which was very famous in that country, he was told that he should die at Ecbatan. This he had always understood of Ecbatan in Media, and had therefore resolved to avoid it. Being now, however, convinced that his end approached, he assembled the chief Persian lords who served in the army, and having told them that his brother was certainly dead, he exhorted them never to submit to the impostor, or suffer the sovereignty again to pass from the Persians to the Medes, to which nation Smerdis belonged, but to use their utmost endeavours to place one of their own blood on the throne.

15
His death.

As the king's wound mortified, he lived but a few days after this; but the assembly supposing that he had spoken only out of hatred to his brother, quietly submitted to the impostor, who was thus for a time established on the throne. Indeed, from his conduct during the short time which he enjoyed the kingdom, he appears to have been not at all undeserving of a crown.

16
Reign of Smerdis the magian.

He began with granting to all his subjects an exemption from taxes and military service for three years, and treated all of them in the most beneficent manner. To secure himself on the throne the more effectually, he married Atossa the daughter of Cyrus; thinking, that in case of a discovery he might hold the empire by her title. She had before been married to her brother Cambyses, on a decision of the magi that a king of Persia might do as he pleased; and by virtue of this decision Smerdis also married her as her brother. The extreme caution of Smerdis, however, promoted the discovery of his imposture. He had married all his predecessors wives, among whom was one Phedyma, the daughter of Otanes a Persian nobleman of the first rank.

17
His imposture discovered.

Otanes, who suspected that the king was not Smerdis the son of Cyrus, sent a trusty messenger to his daughter, desiring to know whether he was so or not; but Phedyma, having never seen this Smerdis, could not give any answer. Her father then desired her to inquire at Atossa, who could not but know her own brother. However, he was again disappointed; for Phedyma acquainted him that all the king's wives were lodged in distinct and separate apartments, without being allowed to see each other. This greatly increased the suspicions of Otanes; upon which he sent his daughter a third message, desiring her, the next time she should be admitted to the king's bed, to take an opportunity of feeling whether he had ears or not: for Cyrus had formerly caused the hears of Smerdis the magian to be cut off for some crime of which he had been guilty; so that, if the king had ears, she might then be assured that he was Smerdis the son of Cyrus. The event showed that the suspicions of Otanes were just; and Phedyma having acquainted her father that the king had no ears, a conspiracy was immediately formed against him.

18
A conspiracy formed against him.

While the conspirators were debating about the proper means of carrying their designs into execution, Darius the son of Hystaspes happening to arrive at Susa where his father was governor, they all agreed to make him privy to their design. He told them, at their first meeting, that he thought nobody in the empire but himself had known that Smerdis the son of Cyrus was dead, and the throne usurped by one of the magi; that he had come with a design to kill the usurper, without imparting his design to any one, that the glory of such an action might be entirely his own. But since others were apprised of the imposture, he insisted that the usurper should be dispatched without delay. Otanes, on the other hand, was for putting off the enterprise till some better opportunity offered; but Darius protested, that if they did not make the attempt that very day, he would prevent any one from accusing him, by disclosing the whole matter to the impostor himself.

In the mean time, Smerdis and his brother had by great promises prevailed on Prenaspes (the executioner of the true Smerdis) to bind himself by an oath not to discover the fraud they had put on the Persians, and even to make a public speech, declaring that the present king of Persia was really the son of Cyrus. At the time appointed, he began his discourse with the genealogy of Cyrus, putting his hearers in mind of the great favours the nation had received from that prince. After having extolled Cyrus and his family, to the great astonishment of all present, he confessed the whole transaction with regard to the death of Smerdis; telling the people that the apprehensions of the danger he must inevitably run by publishing the imposture had constrained him to conceal it so long; but now, not being able any longer to act such a dishonourable part, he acknowledged that he had been compelled by Cambyses to put his brother to death with his own hand, and that the person who possessed the throne was Smerdis the magian. He then begged pardon of the gods and men for the crime he had committed; and fulminating many imprecations against the Persians if they failed to recover the sovereignty, he threw himself headlong from the top of the tower on which he stood, and died on the spot.

19
[illegible] is killed.

In the meantime the conspirators, who were advancing towards the palace, were informed of what had happened; and Otanes was again for deferring the execution of their enterprise: but Darius insisting upon the danger of delay, they proceeded boldly to the palace; and being admitted by the guards, who did not suspect them, they killed both the usurper and his brother; after which they exposed their heads to the people, and declared the whole imposture. The Persians at this were so enraged, that they fell on the whole sect, and killed every one of the magi they could meet with; and had not the slaughter been stopped by night, not one of the order would have been left alive. The day on which this slaughter happened was afterwards celebrated by the Perians with the greatest solemnity, and called by the name of *Magophonia*, or *the slaughtor of the Magi*. On that festival the magi durst not appear abroad, but were obliged to shut themselves up in their houses. Smerdis the magian reigned only eight months.

When the tumult was a little subsided, the conspirators, who were seven in number, met together in order to elect a new king, or to determine what form of government they should next introduce. Otanes was for a republic; but being overruled by the rest, he declared, that as he was determined not to be a king, neither would he be ruled by one; and therefore insisted that he and his family should ever afterwards remain free from subjection to the royal power. This was not only granted, but it was further agreed by the other six, that whoever was chosen should every year present Otanes with a Median vest, a mark of great distinction among the Persians, because he had been the chief author of the enterprise. They further agreed to meet at a certain place next morning at sunrise on horseback, and that he whose horse first neighed should be king. This being overheard by Oebores, who had the care of Darius's horses, he led a mare over-night to the place, and brought his master's horse to her. The next morning, the horse remembering the place, immediately neighed for the mare; and the five lords dismounting, saluted Darius as their king.

20
Darius Hystaspes chosen king.

Darius Hystaspes was elected king of Persia in the year 522 B. C. Immediately after his accession, he promoted the other six conspirators to the first employments in the kingdom, married the two daughters of Cyrus, Atossa and Artystona, Parmys the daughter of the true Smerdis, and Phedyma the daughter of Otanes, who had detected the imposture of the magian. He then divided the whole empire into 20 satrapies or governments, and appointed a governor over each division, ordering them to pay him an annual tribute. The inhabitants of Colchis, with some others, were enjoined only to make annual presents, and the Arabians to furnish every year such a quantity of frankincense as equalled the weight of 1000 talents. Thus Darius received the yearly tribute of 14,560 Eubœic talents, upwards of 260,000 pounds sterling.

Under Darius, the building of the temple of Jerusalem, which had been obstructed by Cambyses and Smerdis, went on successfully, and the Jewish state was entirely restored. The most remarkable of Darius's other transactions were his expeditions against Babylon: against Scythia, India, and Greece. The expedition against Babylon took place in the year 517 B. C. when the people, unable to bear the oppression of the Persians, and likewise discontented because the seat of government was removed from their city to Susa in Persia, took the opportunity of the troubles which happened in the reigns of Cambyses and Smerdis, to store their city with all kinds of provisions sufficient to serve them for many years; after which they broke out into an open rebellion, and thus quickly brought upon them Darius with all his forces. The Babylonians perceiving themselves shut up by so numerous an army, turned all their thoughts towards the supporting of a long siege, which they imagined would tire out the king's troops. To prevent the consumption of their provisions, they took the most barbarous and cruel resolution that ever was put in execution by any nation. They agreed among themselves to get rid of all unnecessary mouths; and therefore, gathering together all the old men, women, and children, they strangled them without distinction; every one being allowed only to keep the wife he liked best, and a maid-servant to do the work of the house. The siege continued for a year and eight months; nor was there any likelihood of its being ended, when Zopyrus, one of Darius's chief commanders, put him in possession of it by the following stratagem. He cut off his nose and ears, and having mangled his body with stripes in a most cruel manner, he fled to the Babylonians thus disfigured, pretending that he had been so treated by Darius for advising him to raise the siege. Being intrusted with the command of some forces, he cut off several parties of the Persian army, whom Darius thus sacrificed in order to raise the character of Zopyrus the higher among the Babylonians. In this manner he so much established his credit, that at last he was made commander in chief of all the Babylonish forces, and the guard of the city committed entirely to his care; and no sooner was this done than he delivered it up to Darius, who, to prevent their rebelling a second time, beat down the walls of that metropolis to the height of 50 cubits. Three thousand of the most active in the rebellion were impaled; the rest pardoned. As they had destroyed most of their women, the neighbouring nations were commanded to furnish them with wives, and 50,000 women were sent to that city, by which means it was prevented from being depopulated. Zopyrus was rewarded with the highest honours, and had the whole revenues of Babylon bestowed on him for life.

21
Revolt of the Babylonians.

22
His unsuccessful expedition against the Scythians.

After the reduction of Babylon, Darius undertook a Scythian expedition, directed against those nations which lie between the Danube and the Tanais. His pretext for this war was, to revenge the calamities which these nations had brought upon Asia about 120 years before, when they invaded and subdued Media; keeping it in subjection for the space of 28 years, as we have related under that article. In this expedition he was attended with an army of 700,000 men. With these he marched to the Thracian Bosphorus; which having passed on a bridge of boats, he reduced all Thrace. From Thrace he advanced to the Danube, where he had appointed his fleet to meet him. This river he passed on another bridge of boats, and entered Scythia. His enemies, however, were too wise to oppose such a formidable power in the open field; and therefore retired before him, wasting the country as they went along, till at last the king, sensible of the danger he was in, resolved to give over the enterprise and return home. In order to do so with safety, he lighted a great number of fires in the night-time, and decamped; leaving behind him the old men and the sick, who fell into the hands of their enemies. The Scythians perceiving that Darius was gone, detached a considerable body to the bridge over the Danube; and as they were well acquainted with the roads, they got thither before the Persians. The Scythians had sent expresses before hand to persuade the Ionians, whom Darius had left to guard the bridge, to break it down and retire to their own country; and this they pressed the more earnestly, that as the time prescribed by Darius was now expired, they were at liberty to return home, without breaking their word or being wanting in their duty. Miltiades, prince of the Chersonesus of Thrace, was for embracing so favourable an opportunity of cutting off Darius's retreat, and shaking off the Persian yoke at once: all the other commanders agreed with him, except Hystiæus prince of Miletus; who represented to the Ionian chiefs, that their power was connected with that of Darius, since it was under his protection that each of them was lord in his own city; and that the cities of Ionia would not fail to depose them and recover their liberty, if the Persian power should sink or decline. This speech made a deep impression on the rest, and it was at last determined that they should wait for Darius; and in order to deceive the Scythians, they began to break down the bridge, but advised them to return back and defeat Darius. They did so, but missed him; and he having thus safely escaped so great a danger, immediately repassed the Bosphorus, and took up his winter quarters at Sardis, leaving Megabyzus, one of his chief generals, to complete the conquest of Thrace.

23 He conquers India.

The king having sufficiently refreshed his troops who had suffered extremely in the Scythian expedition, began to think of extending his dominions eastward; and in order to facilitate his design, resolved in the first place to discover those countries. With this view he caused a fleet to be built and equipped at Caspatyrus, a city on the river Indus. The command of this fleet he gave to one Scylax, a Grecian of Caryandia, a city of Caria, who was well versed in maritime affairs. Him he ordered to sail down the current, and make the best discoveries he could of the countries lying on either side of the river, till he arrived at the southern ocean; from whence he was to steer his course westward, and that way return to Persia. Scylax, having exactly observed his instructions, and sailed down the river Indus, entered the Red sea by the straits of Babelmandel, and on the thirtieth month from his first setting out, landed at the same place from whence Nechu king of Egypt formerly sent out the Phœnicians who circumnavigated Africa. From hence Scylax returned to Susa, where he gave a full account of his discoveries; upon which Darius, marching into India at the head of a powerful army, reduced that large country, and made it a province of the Persian empire, drawing from thence an annual tribute of 360 talents of gold.

24 Revolt of the Ionians, &c.

Soon after the expedition of Darius against India happened the revolt of the Ionians, which gave occasion to his expedition into Greece; an account of which is given under the articles ATTICA, GREECE, SPARTA, &c. The ill success which attended him here, however, was so far from making him drop the enterprise, that it only made him the more intent on reducing the Grecians; and he resolved to head his army in person, having attributed his former bad success to the inexperience of his generals. But while he was employed in making the necessary preparations for this purpose, he received intelligence that the Egyptians had revolted, so that he was obliged to make preparations for reducing them also; and before this could be done, the king died, after having reigned 36 years, leaving the throne to his son Xerxes.

25 Expeditions of Xerxes against Egypt and Greece.

This prince ascended the throne of Persia in the year 485 B. C.; and his first enterprise was to reduce the Egyptians; which he effectually did, bringing them into a worse state of slavery than they ever had experienced before. After this he resolved on an expedition into Greece; the unfortunate event of which is related under the article ATTICA. By his misfortunes in the Grecian expedition, he became at last so dispirited, that he thenceforth abandoned all thoughts of war and conquests; but growing tyrannical, and oppressing his subjects, he was murdered in his bed, in the year 464 B. C. and 21st of his reign; and was succeeded by his third son Artaxerxes, surnamed *Longimanus* on account of the great length of his arms.

26 Xerxes succeeded by Artaxerxes Longimanus.

This prince is named *Ahasuerus* in Scripture, and is the same who married Esther, and during the whole of his reign showed the greatest kindness to the Jewish nation. In the beginning of his reign he was opposed by Hystaspes the second son of Xerxes, whom, however, he overcame, though not without considerable difficulty. After this he applied himself to the settlement of the affairs of government, and reforming many abuses which had crept in; and then, being fully established on the throne, he appointed feasts and rejoicings to be made for 180 days in the city of Susa; at one of which he resolved to divorce his queen for disobedience; and afterwards married Esther, as we find it recorded in the sacred writings.

In the fifth year of the reign of Artaxerxes the Egyptians revolted anew, and, being assisted by the Athenians, held out for six years; but were again obliged to submit, and continued in subjection during the whole of his reign. Nothing else remarkable happened during the life of Artaxerxes Longimanus, who died in the 41st year of his reign; and was succeeded by Xerxes II. the only son he had by his queen, though by his concubines he had 17. Xerxes having drunk immoderately at an entertainment immediately after his accession, retired to a chamber in order to refresh himself with sleep; but here he was murdered by Sogdianus, the son of Artaxerxes by one of his concubines, after he had reigned 45 days.

27 Xerxes II.

28 Sogdianus.

Sogdianus was scarce seated on the throne when he put to death Bagorazus, the most faithful of all his father's eunuchs; by which, and the murder of his sovereign, he became generally odious. Upon this, sensible of the dangerous situation in which he was, he sent for one of his brothers named *Ochus*, whom he suspected, with a design to murder him the moment he arrived. Ochus, however, understanding his design, put off, by several pretences, his coming, till he had drawn together a powerful army, with which he advanced to the confines of Persia. Here he openly declared, that his design was to revenge his brother's death; which brought over

29 Ochus.

to him many of the nobility and governors of provinces, by whom he was immediately proclaimed king. Sogdianus, seeing himself thus deserted, contrary to the advice of all his friends, came to an accommodation with Ochus; who no sooner had him in his power than he caused him to be suffocated among ashes; a punishment invented on purpose for him.

Ochus being firmly settled on the throne by the death of Sogdianus, changed his name to Darius; and is by historians commonly called *Darius Nothus*, or *The Bastard*. But Arsites, another of the brothers, seeing in what manner Sogdianus had got the better of Xerxes, and been afterwards driven out by Ochus, began to entertain thoughts of treating him in the same manner. He was not, however, so successful; for, being defeated in an engagement, he surrendered himself in hopes of mercy, but was immediately put to death by suffocation in ashes. Several other persons were executed; but these severities did not procure him the repose which he expected; for his whole reign was disturbed with violent commotions in various parts of the empire. One of the most dangerous was raised by Pisuthna, governor of Lydia; but he being deserted by his Greek mercenaries, was at last overcome, and put to death: however, his son Amorgas continued to infest the maritime provinces of Asia Minor for two years; till he also was taken prisoner by Tissaphernes, the new governor of Lydia, who put him to death. Other insurrections quickly followed this; but the greatest misfortune which befel Darius during the whole course of his reign was the revolt of the Egyptians, who could not be reduced. Before his death he invested Cyrus his youngest son with the supreme government of all the provinces of Asia Minor. This was done through the persuasions of his mother Parysatis, who had an absolute sway over her husband; and she procured this command for him, that he might thereby be enabled to contend for the kingdom after his father's death. She even insisted that the king should declare him heir to the crown before he died; but this he could not by any means be induced to do. He died in the year 405 B.C. and was succeeded by his son Artaxerxes, by the Greeks surnamed *Mnemon* on account of his extraordinary memory.

30
Artaxerxes Mnemon.

31
Revolt of Cyrus the Younger.

The most remarkable transaction which happened during the reign of this prince was the revolt of his brother Cyrus. This young prince had been raised to so great power through the interest of his mother, on purpose that he might revolt, as we have already seen. He began with gaining over the cities under the government of Tissaphernes; which quickly produced a war with that governor. Cyrus then began to assemble troops, which he pretended were designed only against Tissaphernes. As he had given great assistance to the Lacedæmonians in their wars against the Athenians, he now in return demanded assistance from them; which request they very readily complied with, ordering their fleet immediately to join him, and to obey in every thing the commands of Tamos his admiral. At last Cyrus, having collected an army of 13,000 Greek mercenaries and 100,000 regular troops of other nations, set out from Sardis, directing his march towards Upper Asia; the army being entirely ignorant of the expedition on which they were going. When they arrived at Tarsus, the Greeks, suspecting that they were marching against the king, refused to proceed any further; but Cyrus having gained them over with presents and promises, they soon went on with satisfaction. Having arrived at Cunaxa in the province of Babylon, Cyrus found his brother with 900,000 men ready to engage him. Whereupon, leaping out of his chariot, he commanded his troops to stand to their arms and fall into their ranks; which was done with great expedition, no time being allowed the soldiers to refresh themselves. Clearchus, the commander of the Peloponnesian troops, advised Cyrus not to charge in person, but to remain in the rear of the Greek battalions; but this advice he rejected with indignation, saying, that he should thus render himself unworthy of the crown for which he was fighting. As the king's army drew near, the Greeks fell upon them with such a fury, that they routed the wing opposite to them almost at the first onset; upon which Cyrus was with loud shouts proclaimed king by those who stood next to him. But he, in the mean time, perceiving that Artaxerxes was wheeling about to attack him in flank, advancing against him with 600 chosen horse, killed Artageses captain of the king's guards with his own hand, and put the whole body to flight. In this encounter, discovering his brother, he spurred on his horse, and, coming up to him, engaged him with great fury; which in some degree turned the battle into a single combat. Cyrus killed his brother's horse, and wounded him on the ground; but he immediately mounted another horse, when Cyrus attacked him again, gave him a second wound, and had already lifted up his hand to give him a third, when the guards, perceiving the danger in which their king was, discharged their arrows at once against his antagonist, who at the same time throwing himself headlong upon his brother, was pierced through by his javelin. He fell dead upon the spot; and all the chief lords of his court, resolving not to survive him, were slain in the same place.

32
Battle of Cunaxa.

In the mean time, the Greeks having defeated the enemy's left wing commanded by Tissaphernes, and the king's right wing having put to flight Cyrus's left, both parties, being ignorant of what had passed elsewhere, imagined that they had gained the victory. But Tissaphernes acquainting the king that his men had been put to flight by the Greeks, he immediately rallied his troops, in order to attack them. The Greeks, under the command of Clearchus, easily repulsed them, and pursued them to the foot of the neighbouring hills. As night was drawing near, they halted at the foot of the hill, much surprised that neither Cyrus himself, nor any messenger from him, had appeared; for as yet they knew nothing of his death nor the defeat of the rest of the army. They determined therefore to return to their camp, which they did accordingly; but found there that the greatest part of their baggage had been plundered, and all their provisions taken, which obliged them to pass the night in the camp without any sort of refreshment. The next morning, as they were still expecting to hear from Cyrus, they received the news of his death, and the defeat of that part of the army. Whereupon they sent deputies to Ariæus, who was commander in chief of all the other forces of Cyrus, offering him, as conquerors, the crown of Persia. Ariæus rejected the offer, and acquainting them that he intended to set out early in the morning on his return to Ionia, advised them to join him in the night. They followed his advice, and, under the conduct of Clearchus, began their

33
Retreat of ten thousand Greeks.

march, arriving at his camp about midnight, whence they set out on their return to Greece. They were at a vast distance from their own country, in the very heart of the Persian empire, surrounded by a victorious and numerous army, and had no means of retreat but by forcing their way through an immense tract of the enemy's country. But their valour and resolution mastered all these difficulties; and, in spite of a powerful army, which pursued and harassed them all the way, they made good their retreat for 2325 miles through the provinces belonging to the enemy, and got safe to the Greek cities on the Euxine sea. This retreat (the longest that was ever made through an enemy's country) was conducted at first by Clearchus; but he being cut off through the treachery of Tissaphernes, Xenophon was chosen in his room, who at last brought his men safe into Greece: but for a full account of that famous retreat, see the article XENOPHON.

34
War with the Lacedæmonians.

The war with Cyrus was scarcely ended, when another broke out with the Lacedæmonians, on the following account. Tissaphernes being appointed to succeed Cyrus in all his power, to which was added all which he himself possessed formerly, began to oppress the Greek cities in Asia in a most cruel manner. On this they sent ambassadors to Sparta, desiring the assistance of that powerful republic. The Spartans, having ended their long war with the Athenians, willingly laid hold of the present opportunity of breaking again with the Persians, and therefore sent against them an army under the command of Thimbro, who, being strengthened by the forces which returned under Xenophon, took the field against Tissaphernes. But Thimbro being soon recalled upon some complaints, Dercyllidas, a brave officer and experienced engineer, was appointed to succeed him; and he carried on the war to much more advantage than his predecessor. On his arrival in Asia, finding that Tissaphernes was at variance with another governor named *Pharnabazus*, he concluded a truce with the former, and marching against Pharnabazus, drove him quite out of Æolis, and took several cities in other parts. The latter, however, immediately repaired to the Persian court, where he made loud complaints against Tissaphernes, but gave the king a most salutary advice, which was to equip a powerful fleet, and give the command of it to Conon the Athenian, the best sea officer of his time, by which means he would obstruct the passage of further recruits from Greece; and thus soon put an end to the power of the Lacedæmonians in Asia. This advice being approved of, the king ordered 500 talents for the equipment of a fleet, with directions to give Conon the command of it.

In the mean time, Dercyllidas, with all his valour and skill, suffered himself to be drawn into such a disadvantageous situation that he must inevitably have been destroyed with his whole army, had it not been through the cowardice of Tissaphernes, who having experienced the Grecian valour at the battle of Cunaxa, could not by any means be induced to attack them. The Lacedæmonians, however, having heard that the Persian monarch was fitting out a great fleet against them, resolved to push on the war as vigorously as possible; and for this purpose sent over Agesilaus one of their kings, and a most experienced commander, into Asia. This expedition was carried on with such secrecy, that Agesilaus arrived at Ephesus before the Persians had the least notice of his designs. Here he took the field with 10,000 foot and 4000 horse, and falling upon the enemy while they were totally unprepared, carried every thing before him. Tissaphernes deceived him into a truce till he had leisure to assemble his forces, but gained little by his treachery; for Agesilaus deceived him in his turn, and while Tissaphernes marched his troops into Caria, the Greeks invaded and plundered Phrygia.

Early in the spring, Agesilaus gave out that his design was to invade Lydia; but Tissaphernes, who remembered the last year's stratagem, now taking it for granted that Agesilaus would really invade Caria, made his troops again march to the defence of that province. But Agesilaus now led his army into Lydia as he had given out, and approached Sardis; upon which Tissaphernes recalled his forces from their former route, with a design to relieve the place. But Caria being a very mountainous country, and unfit for horse, he had marched thither only with the foot, and left the horse behind on the borders of that province. Whence, on their marching back to the relief of Sardis, the horse being some days march before the foot, Agesilaus took the advantage of so favourable an opportunity, and fell upon them before the foot could come to their assistance. The Persians were routed at the very first onset; after which Agesilaus overran the whole country, enriching both himself and his army with the spoils of the conquered Persians.

By this continued ill fortune Artaxerxes was so much provoked against Tissaphernes, that he soon after caused him to be put to death.

On the death of Tissaphernes, Tithraustes, who was appointed to succeed him, sent large presents to Agesilaus, in hopes of persuading him to abandon his conquests; but finding that commander was not by any means to be induced to relinquish the war, he sent Timocrates of Rhodes into Greece, with large sums of money to corrupt the leading men in the cities, and rekindle a war against the Lacedæmonians. This stratagem produced the intended effect; for the cities of Thebes, Argos, Corinth, and others, entering into a confederacy, obliged them to recal Agesilaus to the defence of his own country.

35
Agesilaus obliged to leave Asia.

36
Lacedæmonians defeated.

After the departure of Agesilaus, which happened in the year 354 B. C. the Lacedæmonian power received a severe blow at Cnidos, where their fleet was entirely defeated by that of Artaxerxes under Conon, 50 of their ships being taken in the engagement; after which, Conon and Pharnabazus being masters of the sea, sailed round the islands and coasts of Asia, taking the cities there which had been reduced by the Lacedæmonians. Sestos and Abydos only held out, and resisted the utmost efforts of the enemy, though they had been besieged both by sea and land.

Next year Conon having assembled a powerful fleet, again took Pharnabazus on board, and reduced the island of Melos, from whence he made a descent on the coasts of Lycaonia, pillaging all the maritime provinces, and loading his fleet with an immense booty. After this, Conon obtained leave of him to repair to Athens with 80 ships and 50 talents, in order to rebuild the walls of that city; having first convinced

Pharnabazus, that nothing could more effectually contribute to the weakening of the power of Sparta than putting Athens again in a condition to rival its power. He no sooner arrived at Piræus the port of Athens, but he began to work; which, as he had a great number of hands, and was seconded by the zeal of all those that were well inclined to the Athenians, was soon completed, and the city not only restored to its former splendour, but rendered more formidable than ever. The Lacedæmonians were now reduced to the necessity of accepting such terms of peace as they could procure. The terms were, that all the Greek cities in Asia should be subject to the king of Persia, as also the islands of Cyprus and Clazomena; that the islands of Scyros, Lemnos, and Imbros, should be restored to the Athenians, and all the cities of Greece, whether small or great, should be declared free; and by the same treaty, Artaxerxes engaged to join those who accepted the terms he proposed, and to assist them to the utmost of his power against such as should reject them.

37
Are obliged to make peace with the Persians.

38
Cyprus reduced.

Artaxerxes, being now disengaged from the Grecian war, turned his arms against Evagoras king of Cyprus. This man was descended from the ancient kings of Salamine the capital city of the island of Cyprus. His ancestors had held that city for many ages in quality of sovereigns; but were at last driven out by the Persians, who, making themselves masters of the whole island, reduced it to a Persian province. Evagoras, however, being a man of an enterprising genius, soon became weary of living in subjection to a foreign power, drove out the Persian governor, and recovered his paternal kingdom. Artaxerxes attempted to drive him out of it; but, being diverted by the Greek war, was obliged to put off the enterprize. However, Conon, by means of Ctesias chief physician to Artaxerxes, got all differences accommodated, and Artaxerxes promised not to molest him in the possession of his small kingdom. But Evagoras soon becoming discontented with such a narrow possession, gradually reduced under his subjection almost the whole of the island. Some, however, there were, who held out against him, and these immediately applied to Artaxerxes for assistance; and he, as soon as the war with Greece was at an end, bent all his force against Evagoras, intending to drive him quite out of the island. The Athenians, however, notwithstanding the favours lately conferred upon them by the king of Persia, could not forbear assisting their old ally in such a dreadful emergency. Accordingly, they sent him ten men of war under the command of Philocrates; but the Lacedæmonian fleet, commanded by Talentias brother to Agesilaus, falling in with them near the isle of Rhodes, surrounded them, so that not one ship could escape. The Athenians, determined to assist Evagoras at all events, sent Chabrias with another fleet and a considerable body of land forces; and with the assistance of these he quickly reduced the whole island. But in a short time, the Athenians being obliged, in consequence of the treaty concluded with the Persians, to recal Chabrias, Artaxerxes attacked the island with an army of 300,000 men, and a fleet of 300 ships. Evagoras applied to the Egyptians, Libyans, Arabians, Tyrians, and other nations, from whom he received supplies both of men and money; and fitted out a fleet, with which he ventured an engagement with that of Artaxerxes. But being defeated, and obliged to shut himself up in Salamine, he was closely besieged by sea and land. Here at last he was obliged to capitulate, and abandon to the Persians the whole of the island except Salamine, which he held as a king tributary to Artaxerxes.

39
Unsuccessful expeditions against the Cadusians and Egyptians.

The Cyprian war being ended, Artaxerxes turned his arms against the Cadusians, whose country lay between the Euxine and Caspian seas. But these nations were too well accustomed to war to be overcome by the Persians; and therefore the king was obliged to abandon the project, after having lost a great number of his troops and all the horses which he took out with him. In his Egyptian expedition, which happened immediately after the Cadusian war, he was attended with little better success; which, however, was owing to the bad conduct of his general Pharnabazus. This commander being entrusted with the management of the Egyptian war, sent an ambassador to Athens, complaining that Chabrias had engaged in the service of an enemy of the king of Persia, with whom the state of Athens was in alliance, and threatening the republic with his master's resentment if proper satisfaction was not given: at the same time he demanded Iphicrates, another Athenian, and the best general of his time, to command the Greek mercenaries in the Persian service. This the Athenians complied with; and Iphicrates having mustered his troops, so exercised them in all the arts of war, that they became afterwards very famous among the Greeks under the name of *Iphicratesian soldiers*. Indeed he had sufficient time to instruct them; for the Persians were so slow in their preparations, that two whole years elapsed before they were ready to take the field. At the same time Artaxerxes, that he might draw the more mercenaries out of Greece, sent ambassadors to the different states in it, declaring it to be his will and pleasure that they should live at peace with each other, on the terms of the treaty lately concluded: which declaration was received with pleasure by all the states except Thebes, who aspired at the sovereignty of Greece; and accordingly refused to conform to it. All things, however, at last being ready for the expedition, the troops were mustered at the city then called *Acc*, and since *Ptolemais;* where they were found to consist of 200,000 Persians under the command of Pharnabazus, and 20,000 Greeks led by Iphicrates. The fleet consisted of 300 galleys, besides a vast number of other vessels which followed with provisions. The fleet and army began to move at the same time; and that they might act in concert, they separated as little as possible. It was proposed, that the war should begin with the siege of Pelusium; but Nectanebus, the revolted king of Egypt, had provided so well for the defence of the place, that it was thought expedient to drop the enterprize, and make a descent at one of the mouths of the Nile. In this they succeeded: for the Egyptians not expecting them at that place, had not taken such care to fortify it as at Pelusium. The fortress of consequence was easily taken, and all the Egyptians in it put to the sword. After this, Iphicrates was for embarking the troops without loss of time, and attacking Memphis the capital of Egypt. Had this opinion been followed before the Egyptians recovered from the consternation into which they were thrown, it is highly probable that the whole country might have been reduced at once: but Pharnabazus would undertake nothing before the rest of the forces were come up. Iphicrates then, in the

the utmost vexation at losing so favourable an opportunity, pressed Pharnabazus to allow him to attack the place with the Greek mercenaries only; but he refused this also, from a mean jealousy of the honour which Iphicrates might acquire; and in the mean time the Egyptians recovered sufficient courage to put themselves in such a posture of defence, that they could not be attacked with any probability of success; and at the same time, the Nile overflowing as usual, obliged them to return to Phœnice. The expedition was again undertaken 12 years after, but without success.

40
Ochus succeeds Artaxerxes.

The last years of the reign of Artaxerxes were greatly disturbed by dissensions in his family; which at last broke his heart, and he died in the 94th year of his age, and 46th of his reign. He was succeeded by one of his sons named *Ochus*, who behaved with such cruelty, that almost one half of his dominions revolted as soon as he came to the throne. But, by reason of the dissensions of the rebels among themselves, all of them were reduced, one after another; and among the rest, the Sidonians, finding themselves betrayed, burnt themselves to the number of 40,000, together with their wives and children.

41
Reduces Egypt.

Ochus, having quelled all the insurgents, immediately set himself about reducing Egypt, and for this purpose procured a reinforcement of other 10,000 mercenaries from Greece. On his march, he lost a great number of his men drowned in the lake Serbonis, which lies between Phœnice and Egypt, extending about 30 miles in length. When the south wind blows, the whole surface of this lake is covered with sand, in such a manner that no one can distinguish it from the firm land. Several parties of Ochus's army were lost in it for want of proper guides; and it is said that whole armies have sometimes perished in the same place. When he arrived in Egypt, he detached three bodies to invade the country in different parts; each being commanded by a Persian and a Greek general. The first was led by Lachares the Theban, and Rosaces governor of Lydia and Ionia: the second by Nicostratus the Theban and Aristazanes; the third by Mentor the Rhodian and Bagoas an eunuch. The main body of the army he kept with himself, and encamped near Pelusium, with a design to watch the events of the war there. The event was successful, as we have related under the article EGYPT; and Ochus having reduced the whole country, dismantled their strongholds, plundered the temples, and returned to Babylon loaded with booty.

The king, having ended this war with such success, conferred very high rewards on his mercenaries and others who had distinguished themselves. To Mentor the Rhodian he gave 100 talents, and other presents to a great value; appointing him also governor of all the coasts of Asia, and committing to his care the whole management of the war which he was still carrying on against some provinces that had revolted in the beginning of his reign; and all these either by stratagems, or by force, he at last reduced; restoring the king's authority in all these places.—Ochus then, finding himself free from all troubles, gave his attention to nothing but his pleasures, leaving the administration of affairs entirely to Bagoas the eunuch, and to Mentor. These two agreed to share the power between them; in consequence of which the former had the provinces of Upper Asia, and the latter all the rest. Bagoas, being by birth an Egyptian, had a great zeal for the religion of his country, and endeavoured, on the conquest of Egypt, to influence the king in favour of the Egyptian ceremonies; but, in spite of all his endeavours, Ochus not only refused to comply, but killed the sacred bull, the emblem of the Egyptian god Apis, plundered the temples, and carried away their sacred records. This Bagoas supposed to be the highest guilt which a human creature could commit; and therefore poisoned his master and benefactor in the 21st year of his reign. Nor did his revenge stop here; for he kept the king's body, causing another to be buried in its stead; and because the king had caused his attendants eat the flesh of Apis, Bagoas cut his body in pieces, and gave it so mangled to be devoured by cats, making handles for swords of his bones. He then placed Arses the youngest of the deceased king's sons on the throne, that he might the more easily preserve the whole power to himself.

42
Ochus murdered by Bagoas.

43
Darius Codomannus.

Arses did not long enjoy even the shadow of power which Bagoas allowed him, being murdered in the second year of his reign by that treacherous eunuch, who now conferred the crown on Darius Codomannus, a distant relation of the royal family. Neither did he incline to let him enjoy the crown much longer than his predecessor; for, finding that he would not suffer himself to be guided by him in all things, the treacherous Bagoas brought him a poisonous potion; but Darius got rid of him by his own artifice, causing him to drink the poison which he brought. This established Darius in the throne as far as security from internal enemies could do so; but in a very little time his dominions were invaded, and, we may say, the same moment conquered, by Alexander the Great. The particulars of that hero's conquest are related under the article MACEDON; we shall therefore here only take notice of the fate of Darius himself, with which the Persian empire concluded for many ages. After the battle of Arbela, which was decisive in favour of Alexander, the latter took and plundered Persepolis, from whence he marched into Media, in order to pursue Darius, who had fled to Ecbatan the capital of that province. This unhappy prince had still an army of 30,000 foot, among whom were 4000 Greeks, who continued faithful to the last. Besides these, he had 4000 slingers and 3000 horse, most of them Bactrians, and commanded by Bessus governor of Bactria. When Darius heard that Alexander was marching to Ecbatan, he retired into Bactria, with a design to raise another army; but soon after, changing his mind, he determined to venture a battle with the forces he still had left. On this Bessus governor of Bactria, and Nabarzanes a Persian lord of great distinction, formed a conspiracy against him, proposing to seize his person, and, if Alexander pursued them, to gain his friendship and protection by betraying their master into his hands; but if they escaped, their design was to murder him, and usurp the crown. The troops were easily gained over, by representing to them the desperate situation of Darius's affairs; but Darius himself, though informed of their proceedings, and solicited to trust his person among the Greeks, refused to give credit to the report, or follow such a salutary counsel. The consequence of this was, that he was in a few days seized by the traitors; who, out of respect to the

44
Persia conquered by Alexander the Great.

45
Darius seized by his own subjects,

royal dignity, bound him with golden chains, and shutting him up in a covered cart, fled with him towards Bactria. The cart was covered with skins, and strangers appointed to drive it without knowing who the prisoner was. Bessus was proclaimed commander in chief in the room of Darius by the Bactrian horse; but Artabazus and his sons, with the forces they commanded, and the Greeks, under the command of one *Patron*, retired from the body of the army under Bessus, and marched over the mountains towards Parthiene. In the mean time Alexander arriving at Ecbatan, was informed that Darius had left the place five days before. He then dispatched orders to Clitus, who had fallen sick at Susa, to repair, as soon as he recovered to Ecbatan, and from thence to follow him into Parthia with the cavalry and 6000 Macedonians, who were left in Ecbatan. Alexander himself with the rest of the army pursued Darius; and the 11th day arrived at *Rhages*, having marched in that space of time 3300 furlongs. Most of those who accompanied him died through the fatigue of so long a march; insomuch that, on his arrival at Rhages, he could scarcely muster 60 horsemen. Finding that he could not come up with Darius, who had already passed the Caspian straits, he staid five days at Rhages, in order to refresh his army and settle the affairs of Media. From thence he marched into Parthia, and encamped at a small distance from the Caspian straits, which he passed the next day without opposition. He had scarcely entered Parthia, when he was informed that Bessus and Nabarzanes had conspired against Darius, and designed to seize him. Hereupon, leaving the main body of the army behind with Craterus, he advanced with a small troop of horse lightly armed; and having marched day and night without ever halting, except for a few hours, he came on the third day to a village where Bessus with his Bactrians had encamped the day before. Here he understood that Darius had been seized by the traitors; that Bessus had caused him to be shut up in a close cart, which he had sent before, that he might be the more sure of his person; and that the whole army except Artabazus and the Greeks, who had taken another route, obeyed Bessus. Alexander therefore taking with him a small body of light-armed horse, for the others could not possibly proceed further, at last came in sight of the barbarians, who were marching in great confusion. His unexpected appearance struck them, though far superior in number, with such terror, that they immediately betook themselves to flight; and because Darius refused to follow them, Bessus and those who were about him discharged their darts at the unfortunate prince, leaving him wallowing in his blood.

46
and murdered.

After this they all fled different ways, and were pursued with great slaughter by the Macedonians. In the mean time the horses that drew the cart in which Darius was, stopped of their own accord (for the drivers had been killed by Bessus), near a village about four furlongs from the highway. Thither Polystratus a Macedonian, being pressed with thirst in the pursuit of the enemy, was directed by the inhabitants to a fountain to refresh himself, not far from the place where they stopped. As he was filling his helmet with water, he heard the groans of a dying man; and looking round him, discovered a cart with a team of horses, unable to move by reason of the many wounds they had received. When he drew near, he perceived Darius lying in the cart, and very near his end, having several darts sticking in his body. However, he had strength enough left to call for some water, which Polystratus readily brought him. Darius, after drinking, turned to the Macedonian, and with a faint voice told him, that, in the deplorable state to which he was reduced, it was no small comfort to him that his last words would not be lost: he then charged him to return his hearty thanks to Alexander for the kindness he had shown to his wife and family, and to acquaint him, that, with his last breath, he besought the gods to prosper him in all his undertakings, and make him sole monarch of the universe. He added, that it did not so much concern him as Alexander to pursue and bring to condign punishment those traitors who had treated their lawful sovereign with such cruelty, that being the common cause of all crowned heads. Then, taking Polystratus by the hand, "Give Alexander your hand, says he, as I give you mine, and carry him, in my name, the only pledge I am able to give, in this condition, of my gratitude and affection." Having uttered these words, he expired in the arms of Polystratus. Alexander coming up a few minutes after, bewailed his death, and caused his body to be interred with the highest honours.

47
His murderers pursued.

The traitor Bessus being at last reduced to extreme difficulties, was delivered up by his own men naked and bound into the hands of the Macedonians; on which Alexander gave him up to Oxathres the brother of Darius, to suffer what punishment he should think proper. Plutarch tells us that he was executed in the following manner: Several trees being by main force bent down to the ground, and one of the traitor's limbs tied to each of them, the trees, as they were suffered to return to their natural position, flew back with such violence, that each carried with it the limb that was tied to it.

48
Revolt of the Parthians.

Thus ended the empire of Persia, 209 years after it had been founded by Cyrus. After the death of Alexander the Persian dominions became subject to Seleucus Nicator, and continued subject to him for 62 years, when the Parthians revolted, and conquered the greatest part of them. To the Parthians they continued subject for 475 years; when the sovereignty was again restored to the Persians, as related under the article PARTHIA.

49
Persian empire again restored by Artaxerxes.

The restorer of the Persian monarchy was Artaxerxes, or Artaxares, who was not only a private person, but of spurious birth. However, he possessed great abilities, by which means he executed his ambitious projects. He was no sooner seated on the throne than he took the pompous title of *king of kings*, and formed a design of restoring the empire to its ancient glory. He therefore gave notice to the Roman governors of the provinces bordering on his dominions, that he had a just right, as the successor of Cyrus, to all the Lesser Asia; which he therefore commanded them immediately to quit, as well as the provinces on the frontiers of the ancient Parthian kingdom, which were already his. The consequence of this was a war with Alexander Severus the Roman emperor. Concerning the event of this war there are very different accounts. It is certain, however, that on account of his exploits against Artaxares, Alexander took the titles of *Parthicus* and *Persicus*; though, it would seem, with no great

great reason, as the Persian monarch lost none of his dominions, and his successors were equally ready with himself to invade the Roman territories.

50 Succeeded by Sapor, who takes Valerian the Roman emperor prisoner;

51 and treats him cruelly.

Artaxares dying after a reign of 12 or 15 years, was succeeded by his son Sapor; a prince of great abilities both of body and mind, but fierce, haughty, untractable, and cruel. He was no sooner seated on the throne than he began a new war with the Romans. In the beginning he was unsuccessful; being obliged, by the young emperor Gordian, to withdraw from the Roman dominions, and was even invaded in his turn; but, in a short time, Gordian being murdered by Philip, the new emperor made peace with him upon terms very advantageous to the Persians. He was no sooner gone than Sapor renewed his incursions, and made such alarming progress, that the emperor Valerian, at the age of 70, marched against him in person with a numerous army. An engagement ensued, in which the Romans were defeated, and Valerian taken prisoner. Sapor pursued his advantages with such insolence of cruelty, that the people of the provinces took arms, first under Callistus a Roman general, and then under Odenatus prince of Palmyrene. Thus they not only protected themselves from the insults of the Persians, but even gained many great victories over them, and drove Sapor with disgrace into his own dominions. In his march he is said to have made use of the bodies of his unfortunate prisoners to fill up the hollow roads, and to facilitate the passage of his carriages over such rivers as lay in his way. On his return to Persia, he was solicited by the kings of the Cadusians, Armenians, Bactrians, and other nations, to set Valerian at liberty; but to no purpose. On the contrary, he used him the worse; treated him daily with indignities, set his foot upon his neck when he mounted his horse, and, as is affirmed by some, flayed him alive after some years confinement; and caused his skin to be tanned, which he kept as a monument of his victory over the Romans. This extreme insolence and cruelty was followed by an uninterrupted course of misfortune. Odenatus defeated him in every engagement, and even seemed ready to overthrow his empire; and after him Aurelian took ample vengeance for the captivity of Valerian. Sapor died in the year of Christ 273, after having reigned 31 years; and was succeeded by his son Hormisdas, and he by Varanes I. Concerning both these princes we know nothing more than that the former reigned a year and ten days, and the latter three years; after which he left the crown to Varanes II. who seems to have been so much awed by the power of the Romans, that he durst undertake nothing. The rest of the Persian history, to the overthrow of the empire by the Saracens, affords nothing but an account of their continued invasions of the Roman empire, which more properly belongs to the history of ROME: and to which therefore we refer.

52 The Persian empire overthrown by the Saracens.

The last of the Persian monarchs, of the line of Artaxares, was Isdigertes, or Jezdegerd, as he is called by the Arabian and Persian historians, who was cotemporary with Omar the second caliph after Mahomet. He was scarcely seated on the throne, when he found himself attacked by a powerful army of Saracens under the command of one Sad, who invaded the country through Chaldea. The Persian general took all imaginable pains to harass the Arabs on their march; and having an army superior to them in numbers, employed them continually in skirmishes; which were sometimes favourable to him and sometimes otherwise. But Sad, perceiving that this lingering war would destroy his army, determined to hasten forward, and force the enemy to a general engagement. The Persians declined this for a long time; but at length, finding a convenient plain where all their forces might act, they drew up in order of battle, and resolved to wait for the Arabs. Sad having disposed his men in the best order he could, attacked the Persians with the utmost fury. The battle lasted three days and three night; the Persians retiring continually from one post to another, till at last they were entirely defeated; and thus the capital city, and the greatest part of the dominions of Persia, fell into the hands of the Arabs. The conquerors seized the treasures of the king; which were so vast, that, according to a Mahometan tradition, their prophet gave the Saracen army a miraculous view of those treasures before the engagement, in order to encourage them to fight.

After the loss of this battle, Jezdegerd retired into Chorasan, where he maintained himself as king, having under his subjection two other provinces, named *Kerman* and *Segestan*. But after he had reigned in this limited manner for 19 years, one of the governors of the few towns he had left betrayed it, and called in the Turks. This place was called *Merou*, seated on the river Gihon or Oxus. Jezdegerd immediately marched against the rebels and their allies. The Persians were defeated; and the unfortunate monarch, having with much difficulty reached the river, found there a little boat, and a fisherman to whom it belonged. The king offered him a bracelet of precious stones; but the fellow, equally brutal and stupid, told him that his fare was five farthings, and that he would neither take more nor less. While they disputed, a party of the rebel horse came up, and knowing Jezdegerd, killed him, in the year 652.

Jezdegerd left behind him a son named *Firouz*. and a daughter named *Dara*. The latter espoused Bostenay, whom the rabbinical writers have dignified with the title of the *head of the captivity;* and who, in fact, was the prince of the Jews settled in Chaldea. As for Firouz, he still preserved a little principality; and when he died, left a daughter named *Mah Afrid*, who married Walid the son of the caliph Abdalmalek, by whom she had a son named *Yezid*, who became caliph, and consequently sovereign of Persia; and so far was this prince from thinking himself above claiming the title derived from his mother, that he constantly styled himself *the son of Khosrou king of Persia, the descendant of the caliph Maroan, and among whose ancestors on the side of the mother were the Roman emperor and the khacan.*

53 State of Persia under the Mogul princes.

Persia continued to be subject to the Arabs till the decline of the Saracen empire, when it was seized by various usurpers, till the time of Jenghis Khan, who conquered it as well as almost all the rest of Asia. After his death, which happened in the year 1227, Persia, together with the neighbouring countries, were governed by officers appointed by his successors, who reigned at Kærakorom, in the eastern parts of Tartary, till the year 1253, when it became once more the seat of a mighty empire under Hulaku the Mogul, who in 1256 abolished the caliphate, by taking the city of BAGDAD, as related under that article. After the death of Hulaku,

laku, his son Abaka succeeded to his extensive dominions; and his first care was to shut up all the avenues of his empire against the other princes of the race of Jenghiz Khan, who reigned in different parts of Tartary. His precautions, however, were of little avail; for in the very beginning of his reign he was invaded by Barkan Khan, of the race of Jagatay the son of Jenghiz Khan, from Great Bukharia, with an army of 300,000 men. Abaka was but indifferently prepared to oppose such a formidable power; but, happily for him, his antagonist died before the armies came to an engagement, upon which the invaders dispersed and returned to Tartary. In the year 1264, Armenia and Anatolia were ravaged by the Mamlukes from Egypt, but they were obliged to fly from Abaka; who thus seemed to be established in the possession of an empire almost as extensive as that of the ancient Persian kings. His tranquillity, however, was of short duration; for, in 1268, his dominions were invaded by Borak Khan, a prince likewise of the race of Jagatay, with an army of 100,000 men. He quickly reduced the province of Chorasan, where he met with little opposition, and in 1269 advanced as far as Aderbijan, where Abaka had the bulk of his forces. A bloody battle ensued; in which Abaka was victorious, and Borak obliged to fly into Tartary, with the loss of all his baggage and great part of his army. Abaka died in 1282, after a reign of 17 years, not without suspicion of being poisoned; and was succeeded by his brother Ahmed Khan. He was the first of the family of Jenghiz Khan who embraced Mahometanism; but neither he nor his successors appear to have been in the least versed in the arts of government; for the Persian history, from this period, becomes only an account of insurrections, murders, rebellions, and poisonings, till the year 1335, when it split all to pieces, and was possessed by a great number of petty princes; all of whom were at perpetual war with each other till the time of Timur Beg, or Tamerlane, who once more reduced them all under one jurisdiction.

54
Under Tamerlane and his successors.

After the death of Tamerlane, Persia continued to be governed by his son Shah Rukh, a wise and valiant prince but immediately after his death fell into the same confusion as before; being held by a great number of petty tyrants, till the beginning of the 16th century, when it was conquered by Shah Ismael Safi, or Sefi; of whose family we have the following account. His father was Sheykh Hayder or Haydr, the son of Sultan Juneyd, the son of Sheykh Ibrahim, the son of Sheykh Ali, the son of Sheykh Musa, the son of Sheykh Sefi, who was the 13th in a direct line from Ali the son-in-law of the prophet Mahomet. When Tamerlane returned from the defeat of Bajazet the Turkish sultan, he carried with him a great number of captives out of Caramania and Anatolia, all of whom he intended to put to death on some remarkable occasion; and with this resolution he entered Ardebil, or Ardevil, a city of Aderbijan, about 25 miles to the east of Taurus, where he continued for some days. At this time lived in that city the Sheykh Safi, or Sefi, above mentioned, reputed by the inhabitants to be a saint, and, as such, much reverenced by them. The fame of Safi's sanctity so much moved Tamerlane, that he paid him frequent visits; and when he was about to depart, promised to grant whatever favour he should ask. Sheykh Safi, who had been informed of Tamerlane's design to put the captives to death, requested of the conqueror that he would spare the lives of those unfortunate men. Tamerlane, desirous of obliging him, not only granted this request, but delivered them up to him to be disposed of as he thought fit; upon which the Sheykh furnished them with clothes and other necessaries as well as he could, and sent them home to their respective countries. This generous action proved very beneficial to the family; for the people were so much affected with such an extraordinary instance of virtue, that they repaired in great numbers to Safi, bringing with them considerable presents; and this so frequently, that few days passed in which he was not visited by many. Thus the descendants of the Sheykh made a conspicuous figure till the year 1486, when they were all destroyed by the Turcomans except Ismael, who fled to Ghilan, where he lived under the protection of the king of that country; after which he became conspicuous on the following occasion.

55
Conquered by Ismael Sefi.

There was at that time, among the Mahometans, a vast number of people dispersed over Asia; and among these a particular party who followed that of Hayde the father of Ismael, which Sheykh Safi, one of his ancestors, had brought into great reputation. Ismael, who had assumed the surname of *Sofi*, or *Sage*, finding that Persia was all in confusion, and hearing that there was a great number of the Hayderian sect in Caramania, removed thither. There he collected 7000 of his party all devoted to the interest of his family; and while he was yet only 14 years of age, conquered Shirwan. After this he pursued his conquests; and as his antagonists never united to oppose him, had conquered the greatest part of Persia, and reduced the city of Bagdad, by the year 1510. However, his conquests on the west side were soon stopped by the Turks; for, in 1511, he received a great defeat from Selim I. who took Tauris; and would probably have crushed the empire of Ismael in its infancy, had he not thought the conquest of Egypt more important than that of Persia. After his defeat by Selim, Ismael never undertook any thing of consequence. He died in 1523, leaving the crown to his eldest son Thamasp I.

The new shah was a man of very limited abilities, and was therefore invaded by the Turks almost instantly on his accession to the throne. However, they were obliged to retreat by an inundation, which overflowed their camp, and which frightened them with its red colour, probably arising from the nature of the soil over which it passed. Thamasp, however, reduced Georgia to a province of the Persian empire; that country being in his time divided among a number of petty princes, who, by reason of their divisions, were able to make little opposition.

56
Reign of Shah Abbas the Great.

The reigns of the succeeding princes afford nothing remarkable till the time of Shah Abbas I. surnamed the *Great*. He ascended the throne in the year 1584; and his first care was to recover from the Turks and Tartars the large provinces they had seized which formerly belonged to the Persian empire. He began with declaring war against the latter, who had seized the finest part of Chorasan. Accordingly, having raised a powerful army, he entered that province, where he was met by Abdallah Khan the chief of the Usbeck Tartars. The two armies lay in sight of each other for six months;

but at length Abbas attacked and defeated his enemies, forcing them, for that time, to abandon Chorasan. Here he continued for three years; and on his leaving that place, fixed the seat of government at Isaphan, where it has continued ever since. His next expedition was against the Turks. Understanding that the garrison of Tauris was in no expectation of an enemy, he formed a design of surprising the place; and having privately assembled a few forces, he marched with such celerity, that he reached a pass called *Shibli* very near Tauris, in six days, though it is usually 18 or 20 days journey for the caravans. Here the Turks had posted a few soldiers, rather for the purpose of collecting the customs on such commodities as were brought that way, than of defending the pass against an enemy. Before they came in sight of this pass, Abbas and some of his officers left the rest of the army, and rode briskly up to the turnpike. Here the secretary of the customhouse taking them for merchants, demanded the usual duties. Abbas replied, that the person who had the purse was behind, but at the same time ordered some money to be given him. But while the secretary was counting it, he was suddenly stabbed by the Shah's order; and the officers who were with him suddenly falling upon the few soldiers who were there, obliged them to submit; after which he entered the pass with his army. The governor of Tauris marched out with all the troops he could collect on so short a warning; but being inferior to the Persians, he was utterly defeated, and himself taken prisoner; after which the city was obliged to submit, as also a number of places in the neighbourhood. One city only called *Orumi*, being very strongly situated, resisted all the efforts of Abbas; but was at last taken by the assistance of the Curds, whom he gained over by promising to share the plunder of the place with them. But instead of this, he formed a design to cut them all off at once; fearing that they might at another time do the Turks a service of the same nature that they had done to him just now. For this reason he invited their chiefs to dine with him; and having brought them to a tent, the entrance to which had several turnings, he stationed on the inside two executioners, who cut off the heads of the guests as soon as they entered.

After this Shah Abbas considerably enlarged his dominions, and repelled two dangerous invasions of the Turks. He attempted also to promote commerce, and civilize his subjects; but stained all his great actions, by his abominable cruelties, which he practised on every one who gave him the least cause of offence; nay frequently without any cause at all. He took the isle of Ormus from the Portuguese, who had kept it since 1507, by the assistance of some English ships in 1622; and died six years after, aged 70.

57 History of Khouli Khan.

The princes who succeeded Shah Abbas the Great, were remarkable only for their cruelties and debaucheries, which occasioned a revolution in 1716, when the Shah Hussein was dethroned by the Afghans, a people inhabiting the country between Persia and India; who being oppressed by the ministers, revolted under the conduct of one Mereweis. The princes of the Afghan race continued to enjoy the sovereignty for no more than 16 years, when Ashraff the reigning shah was dethroned by one of his officers *. On this Thamasp, otherwise called *Prince Thamas*, the only survivor of the family of Abbas, assembling an army, invited into his service Nadir Khan, who had obtained great reputation for his valour and conduct. He was the son of a Persian nobleman, on the frontiers of Usbeck Tartary; and his uncle, who was his guardian, keeping him out of possession of the castle and estate which was his inheritance, he took to robbing the caravans; and, having increased his followers to upwards of 5000 men, became the terror of that part of the country, and especially of his uncle, who had seized his estate. His uncle therefore resolved to make his peace with him, and with that view invited him to the castle, where he entertained him in a splendid manner; but Nadir Khan ordered his throat to be cut next night, and all his people to be turned out of the castle. No sooner had Nadir Khan got the command of the Persian army, than he attacked and defeated the usurper Esriff, put him to death, and recovered all the places the Turks and Russians had made themselves masters of during the rebellion; and then Prince Thamas seemed to be established on the throne: but Nadir Khan, to whom Thamas had given the name of *Thamas Kouli Khan*, that is, *the Slave of Thamas*, thinking his services not sufficiently rewarded, and pretending that the king had a design against his life, or at least to set him aside, conspired against his sovereign, and put him to death, as is supposed: after which, he usurped the throne, styling himself *Shah Nadir* or *King Nadir*.

He afterwards laid siege to Candahar, of which a son of Mereweis had possessed himself. During this siege, the court of the Great Mogul being distracted with factions, one of the parties invited Shah Nadir to come to their assistance, and betrayed the Mogul into his hands. He thereupon marched to Delhi, the capital of India, and summoned all the viceroys and governors of provinces to attend him, and bring with them all the treasures they could raise; and those that did not bring as much as he expected, he tortured and put to death. Having thus amassed the greatest treasure that ever prince was master of, he returned to Persia, giving the Mogul his liberty, on condition of his resigning the provinces on the west side of the Indus to the crown of Persia. He afterwards made a conquest of Usbeck Tartary, and plundered Bochara the capital city. Then he marched against the Daghestan Tartars; but lost great part of his army in their mountains, without fighting. He defeated the Turks in several engagements; but laying siege to Bagdad, was twice compelled to raise the siege. He proceeded to change the religion of Persia to that of Omar, hanged up the chief priests, put his own son to death, and was guilty of such cruelty, that he was at length assassinated by his own relations, anno 1747. A contest upon this ensued between these relations for the crown, which has rendered Persia a scene of the most horrible confusion for upwards of 40 years.

58 Different pretenders to the throne of Persia.

The reader will form some notion of the troubles of this unhappy country from the following series of pretenders to the throne between the death of Nadir and the accession of Kerim Khan. We give it from Francklin's Observations. 1st, Adil Shah.—2d, Ibraheem Shah.—3d, Shah Rokh Shah.—4th, Suleeman Shah.—5th, Ismaeel Shah.—6th, Azan Khan Afghan.—7th, Hossun Khan Kejar.—8th, Ali Merdan Khan Bukhteari.—9th, Kerim Khan Zund.

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* See *Pattans*.

"Their reigns, or more properly the length of time they respectively governed with their party, were as follows: Adil Shah, nine months. Ibraheem Shah, six months. Shah Rokh Shah, after a variety of revolutions, at length regained the city of Meschid: he is now alive (1787), and above 80 years of age, reigning in Chorasan, under the direction of his son Nussir Ullah Meerza. Suleeman Shah, and Ismaeel Shah, in about forty days were both cut off, almost as soon as they were elevated. Azad Khan Afghan, one of Kerim Khan's most formidable rivals and competitors, was subdued by him, brought prisoner to Shirauz, and died there a natural death. Hossun Khan Kejar, another of Kerim Khan's competitors, was besieging Shirauz, when his army suddenly mutinied and deserted him. The mutiny was attributed to their want of pay. A party sent by Kerim Khan took him prisoner. His head was instantly cut off, and presented to Kerim Khan. His family were brought captives to Shirauz. They were well treated, and had their liberty given them soon after, under an obligation not to quit the city. Ali Merdan Khan was killed by a musket shot as he was walking on the ramparts of Meschid encouraging his men. Kerim Khan Zund, by birth a Curdistan, was a most favourite officer of Nadir Shah, and at the time of his death was in the southern provinces. Shirauz and other places had declared for him. He found means at last, after various encounters with doubtful success, completely to subdue all his rivals, and finally to establish himself as ruler of all Persia. He was in power about 30 years; the latter part of which he governed Persia under the appellation of *vakeel* or *regent*, for he never would receive the title of Shah. He made Shirauz the chief city of his residence, in gratitude for the assistance he had received from its inhabitants and those of the southern provinces. He died in the year 1779, regretted by all his subjects, who esteemed and honoured him as the glory of Persia.

59
Kerim Khan enjoyed a reign of near 30 years.

60
Twenty-two officers take possession of the citadel.

"When the death of Kerim Khan was announced in the city, much confusion arose; two and twenty of the principal officers of the army, men of high rank and family, took possession of the ark, or citadel, with a resolution to acknowledge Abul Futtah Khan (the eldest son of the late vakeel) as their sovereign, and to defend him against all other pretenders; whereupon Zikea Khan, a relation of the late vakeel by the mother's side, who was possessed of immense wealth, enlisted a great part of the army into his pay, by giving them very considerable bounties. Zikea Khan was of the tribe of Zund (or the Lackeries); a man remarkably proud, cruel, and unrelenting. Having assembled a large body of troops, he immediately marched them to the citadel, and laid close siege to it for the space of three days; at the expiration of which, finding he could not take it by force, he had recourse to treachery. To each of the principal khans he sent a written paper, by which he swore upon the Koran, that if they would come out and submit to him, not a hair of their heads should be touched, and that they should have their effects secured to them. Upon this a consultation was held by them; and it appearing that they could not subsist many days longer, they agreed to surrender themselves, firmly relying on the promises that had been made them. Zikea Khan, in the mean time, gave private orders, for the khans to be seized, and brought separately before him as they came out of the citadel. His orders were strictly obeyed, and these deluded men were all massacred in his presence; he was seated the whole time, feasting his eyes on the cruel spectacle.

61
Zikea Khan.

62
Besieges he citadel.

63
Employs reacherous means to ntice the fficers out, nd is uccessful.

64
Murdered.

"Zikea Khan's tyranny became soon intolerable, and he was cut off by his own body guard, when Abul Futtah Khan, who was at the time in the camp, was proclaimed king by the unanimous voice of the troops, whom he immediately led back to Shirauz. On his arrival he was acknowledged as sovereign by all ranks of people, and took quiet possession of the government.

65
Mahomed Sadick Khan attempts to seize the government;

"Mahomed Sadick Khan, only brother of the late Kerim Khan, who had during that prince's life filled the high office of beglerbeg of Fars, and had been appointed guardian of his son Abul Futtah Khan, was at this period governor of the city of Bassora, which had been taken by the Persians, previous to the vakeel's death. Upon hearing the news of his brother's decease he became ambitious of reigning alone, and from that instant formed schemes for the destruction of his nephew; but as it was necessary for him to be on the spot for the advancement of his views, he determined to withdraw the Persian garrison from Bassora, who were all devoted to his interest: accordingly he evacuated that place, and marched immediately for Shirauz.

"The news of Sadick Khan's approach threw the inhabitants of Shirauz into the greatest consternation: their minds were variously agitated on the occasion; some, from his known public character, expected he would honestly fulfil the commands of his deceased brother; others, who had been witnesses to the confusion of former times, on similar occasions, rightly imagined that he would set up for himself; and indeed this proved to be the case: for having entered Shirauz a very few days after, he caused Abul Futtah Khan to be seized, deprived of sight, and put into close confinement.

66
which he effects.

"After this event, Sadick Khan openly assumed the government. As soon as the intelligence reached Ali Murad Khan, who was at Ispahan, that lord instantly rebelled: deeming himself to have an equal right to the government with Sadick Khan, as in fact he had, he could ill brook the thought of being obedient to him, and openly declared himself a competitor for the empire. Persia was by this means again involved in all the horrors of a civil war. Ali Murad Khan indeed took possession of Shirauz, assumed the government, and gave to the empire the flattering prospect of being settled under the government of one man; but this prospect was soon obscured by the power and credit acquired by Akau Mahomed Khan."

67
Akau Mahomed Khan collects troops, and is proclaimed at Mazanderan and Ghilan.

On the night following Kerim Khan's death, this man found means to make his escape from Shirauz, and fled to the northward, where collecting some troops, he soon made himself master of Mazanderan and Ghilan, and was proclaimed nearly about the time that Ali Murad Khan had taken Shirauz. "It is remarkable (says our author), that from his first entering into competition for the government, he has been successful in every battle which he has fought. He is an eunuch, having been made so whilst an infant, by the command of Nadir Shah, but possesses great personal bravery."

Ali Murad Khan, hearing of the success of Akau

Mahomed Khan, determined to go against him; but as he was previously proceeding to Ispahan to suppress a rebellion, he fell suddenly from his horse and expired on the spot.

62 Jaafar Khan asserts his pretensions to the government.

"At this period, Jaafar Khan, the eldest and only surviving son of Sadick Khan, was governor of Khom; he deemed this a favourable opportunity to assert his pretensions to the government, and immediately marched with what few troops he had to Ispahan: soon after his arrival he was joined by the greater part of the malcontents, who were then in arms. In this situation he remained some time; but Akau Mahomed Khan coming down upon him with his army, he was obliged to risk his fate in a battle, and, being defeated, fled with the small remains of his troops, taking the road to Shirauz.

69 Is defeated by Aku Mahomed Khan.

Soon after finding himself strengthened by an increase of his army, he determined to venture a second engagement with his opponent Akau Mahomed Khan; and for this purpose marched with his army towards Ispahan: the two armies met near Yezdekhast, when a battle ensued, and Akau Mahomed Khan's superior fortune again prevailing, Jaafar Khan was defeated, and retired to Shirauz, which he quitted on the 25th of June 1787, and shortly after marched his army to the northward, but returned in October without having effected any thing." Such was the state of Persia in 1788. Mr Francklin, from whose excellent Observations on a Tour made in the years 1786-7 these particulars are mostly extracted, says that Jaafar Khan is the most "likely, in case of success against his opponent, to restore the country to a happy and reputable state: but it will require a long space of time to recover it from the calamities into which the different revolutions have brought it:—a country, if an oriental metaphor may be allowed, once blooming as the garden of Eden, fair and flourishing to the eye;—now, sad reverse! despoiled and leafless by the cruel ravages of war, and desolating contention."

70 Air and climate Persia.

As to the air and climate of this country, considering the great extent thereof, it cannot but be very different, according to the situation of its several parts; some being frozen with cold, whilst others are burnt with heat at the same time of the year. The air, wherever it is cold, is dry; but where it is extremely hot, it is sometimes moist. All along the coast of the Persian gulf, from west to east, to the very mouth of the river Indus, the heat for four months is so excessive, that even those who are born in the country, unable to bear it, are forced to quit their houses, and retire to the mountains; so that such as travel in these parts, at that season, find none in the villages, but wretched poor creatures, left there to watch the effects of the rich, at the expence of their own health. The extreme heat of the air, as it is unsupportable, so it makes it prodigiously unwholesome; strangers frequently falling sick there, and seldom escaping. The eastern provinces of Persia, from the river Indus to the borders of Tartary, are subject to great heats, though not quite so unwholesome as on the coasts of the Indian ocean and the Persian gulf; but in the northern provinces, on the coast of the Caspian sea, the heat is full as great, and, though attended with moisture, as unwholesome as on the coast before mentioned. From October to May, there is no country in the world more pleasant than this; but the people carry indelible marks of the malign influence of their summers, looking all of them of a faint yellow, and having neither strength nor spirits; though, about the end of April, they abandon their houses, and retire to the mountains, which are 25 or 30 leagues from the sea. But this moistness in the air is only in these parts; the rest of Persia enjoys a dry air, the sky being perfectly serene, and hardly so much as a cloud seen to fly therein. Though it seldom rains, it does not follow that the heat admits of no mitigation: for in the night, notwithstanding there is not a cloud to be seen, and the sky is so clear, that the stars alone afford a light sufficient to travel by, a brisk wind springs up, which lasts until within an hour of the morning, and gives such a coolness to the air, that a man can bear a tolerable warm garment. The seasons in general, and particularly in the middle of this kingdom, happen thus: the winter, beginning in November, and lasting until March, is very sharp and rude, attended with frost and snow; which last descends in great flakes on the mountains, but never on the plains.

71 Climate of Shirauz.

The climate of Shirauz, the capital of Persia Proper, is represented by a traveller who lately visited it, as one of the most agreeable in the world, the extremes of heat and cold being seldom felt. "During the spring of the year the face of the country appears uncommonly beautiful. The flowers, of which they have a great variety, and of the brightest hues, the fragrant herbs, shrubs, and plants, the rose, the sweet basil, and the myrtle, all here contribute to refresh and perfume the natural mildness of the air. The nightingale of the garden (called by the Persians *boolbul hezar dastaan*), the goldfinch, and the linnet, by their melodious warblings at this delightful season of the year, serve to add to the satisfaction of the mind, and to inspire it with the most pleasing ideas. The beauties of nature are here depicted in their fullest extent; the natural historian and the botanist would here meet with ample scope for pursuing their favourite investigations. With such advantages, added to the salubrity of the air, how can it be wondered at that the inhabitants of Shirauz should so confidently assert the pre-eminence of their own city to any other in the world?—or that such beauties should fail of calling forth the poetical exertions of a Hafiz, a Sadi, or a Jami? The mornings and evenings are cool, but the middle of the day is very pleasant. In summer the thermometer seldom rises above 73 in the day time, and at night it generally sinks as low as 62. The autumn is the worst season of the year, that being the time when the rains begin to fall, and during the autumnal months it is considered by the natives as the most unhealthy; colds, fluxes, and fevers being very general. In winter a vast deal of snow falls, and very thick, but ice is rarely to be found, except on the summits of the mountains, or towards Ispahan, and the more northern parts of Persia. One thing which is most to be esteemed in this country, and renders it preferable to any other part of the world, is their nights, which are always clear and bright: and the dew, that in most places is of so pernicious and dangerous a nature, is not of the least ill consequence here: there is none at all in summer, and in the other seasons it is of such a nature, that if the brightest scimitar should be exposed to it all the night, it would not receive the least rust; a circumstance I have myself experienced. This dryness in the air causes their buildings to last a great while, and is undoubtedly one of the principal reasons that the celebrated ruins of Persepolis have endured for so many ages, and, comparatively speaking, in so perfect a state." The great dryness of the air exempts Persia from thunder and earthquakes. In the spring, indeed, there sometimes falls hail; and, as the harvest is then pretty far advanced, it does a great deal of mischief. The rainbow is seldom seen in this country, because there rise not vapours sufficient to form it; but in the night there are seen rays of light shooting through the firmament, and followed as it were by a train of smoke. The winds, however brisk, seldom swell into storms or tempests; but, on the other hand, they are sometimes poisonous and infectious on the shore of the Gulf, as all travellers agree. M. Tavernier says, that at Gombroon people often find themselves struck by a south wind, in such a manner, that they cry, "I burn!" and immediately fall down dead. M. le Brun tells us, that he was assured while he was there, that the weather was sometimes so excessively sultry as to melt the seals of letters. At this time the people go in their shirts, and are continually sprinkled with cold water; and some even lie several hours naked in the water. Among the inconveniences consequent from this malign disposition of the air, one of the most terrible is the engendering, in the arms and legs, a kind of long small worms, which cannot be extracted without great danger of breaking them; upon which a mortification ensues.

72
Soil.

The soil of Persia is in general stony, sandy, barren, and everywhere so dry, that, if it be not watered, it produces nothing, not even grass; but, where they can turn the water into their plains or valleys, it is not unfruitful. There is a great difference in point of fertility in the different provinces of the empire; and those of Media, Iberia, Hyrcania, and Bactria, are now in a great measure what they were formerly, and surpass most of the others in their productions. All along the Persian gulf, the soil is still more barren, cattle less plenty, and every thing in a worse condition than anywhere else.

73
Produce.

Though there is scarcely a province in Persia which does not produce wine, yet the wine of some provinces is much more esteemed than that of others; but Schiras, or, as it is written by Mr Francklin, *Shiraux*, wine is universally allowed to be the very best in Persia; insomuch, that it is a common proverb there, That to live happily, one must eat the bread of Yezd, and drink the wine of Schiras.

The grain most common in Persia is wheat; which is wonderfully fair and clean. As for barley, rice, and millet, they only make bread of them in some places, as in Courdestan, when their wheat bread is exhausted before the return of harvest. They do not cultivate in this country either oats or rye; except where the Armenians are settled, who make great use of the latter in Lent. Rice is the universal aliment of all sorts of people in Persia; for this reason they are extremely careful in its cultivation; for, after they have sown it in the same manner as other grain, they in three months time transplant it, root by root, into fields, which are well watered, otherwise it would never attain that perfection in which we find it there; since it is softer, sooner boiled, and more delicious, than the same grain in any other part of the world. Perhaps its taste is, in some measure, heightened by a practice which they follow to give it a glossy whiteness, viz. by cleansing it, after it is beaten out of the husks, with a mixture of flour and salt. Corn ripens exceedingly in this country; so that in some parts they have a threefold crop in the year. The Persian bread is generally very thin, white, and good; and commonly cheap enough.

Metals of all sorts have been found in Persia. Since the reign of Shah Abbas the Great, iron, copper, and lead, have been very common; but there are no gold or silver mines open at present; though, as Persia is a very mountainous country, such might very probably be found, if pains were taken to search them out. There are silver mines in Kerman and Mazanderan, and one not far from Spauhawn; but they cannot be worked for want of wood. Minerals are also found in Persia in abundance; especially sulphur, saltpetre, salt, and alum. Nothing is more common in this country than to meet with plains, sometimes 10 leagues in length, covered entirely with salt, and others with sulphur or alum. In some places salt is dug out of mines, and even used in building houses. Marble, freestone, and slate are found in great plenty about Hamadan. The marble is of four colours, viz. white, black, red and black, and white and black. Persia yields two sorts of petroleum or naphtha; namely, black and white. In the neighbourhood of Tauris they find azure; but it is not so good as that brought from Tartary. Among the most valuable productions of Persia are the precious stones called *turquoises*, of which there are several rocks or mines.

The horses of Persia are the most beautiful of the East, though they are not so much esteemed as those of Arabia; so great, however, is the demand for them, that the finest ones will fetch from 90l. to 450l. sterling. They are higher than the English saddle horses; straight before, with a small head, legs wonderfully slender, and finely proportioned; they are mighty gentle, good travellers, very light and sprightly, and do good service till they are 18 or 20 years old. The great numbers of them sold into Turkey and the Indies, though none can be carried out of the kingdom without special license from the king, is what makes them so dear. Next to horses we may reckon mules, which are much esteemed here, and are very fine; and next to these we may justly place asses, of which they have in this country two sorts; the first bred in Persia, heavy and doltish, as asses in other countries are; the other originally of an Arabian breed, the most docile and useful creature of its kind in the world. They are used wholly for the saddle; being remarkable for their easy manner of going, and are very sure-footed, carrying their heads lofty, and moving gracefully. Some of them are valued at 20l. sterling. The mules here are also very fine; they pace well, never fall, and are seldom tired. The highest price of a mule is about 45l. sterling. Camels are also numerous in Persia, and very serviceable; they call them *kechty-krouch-konion*, i. e. "the ships of the land;" because the inland trade is carried on by them as the foreign is by ships. Of these camels there are two sorts, the northern and southern: the latter, which is much the smaller, but swifter, will carry a load of about 700 weight, and trot as fast as a horse will gallop; the other will travel with a load of 1200 or 1300 weight; both are profitable to their masters, as costing little or nothing to keep. They travel without halter or reins; grazing on the road from time to time, notwithstanding their load. They are managed entirely by the voice; those who direct them making use of a kind of song, and the camel moving brisker, or at its ordinary pace, as they keep a quicker or slower time. The camels shed their hair so clean in the spring, that they look like scalded swine: but then they are pitched over, to keep the flies from stinging them. The camel's hair is the most profitable fleece of all the tame beasts: fine stuffs are made of it; and in Europe, hats, with a mixture of a little beaver.

As beef is little eaten in Persia, their oxen are generally employed in ploughing, and other sorts of labour. Hogs are nowhere bred in Persia, if we except a province or two on the borders of the Caspian sea. Sheep and deer are very common throughout all Persia.

Of wild beasts, the number is not great in that country, because there are few forests; but where there are any, as in Hyrcania, now called *Tabristan*, abundance of lions, bears, tygers, leopards, porcupines, wild boars, and wolves are to be found; but the last are not so numerous as any of the other species.

There are but few insects in this country; which may be ascribed to the dryness of the climate. In some provinces, however, there is an infinite number of locusts or grashoppers, which fly about in such clouds as to darken the air. In certain parts of the Persian dominions they have large black scorpions, so venomous, that such as are stung by them die in a few hours. In others they have lizards frightfully ugly, which are an ell long, and as thick as a large toad, their skins being as hard and tough as that of the sea-dog; they are said to attack and kill men sometimes; but that may be doubted. The southern provinces are infested with gnats; some with long legs, like those we call *midges;* and some white, and as small as fleas, which make no buzzing, but sting suddenly, and so smartly that the sting is like the prick of a needle. Among the reptiles is a long square worm, called by the inhabitants *hazar-pey*, i. e. "thousand feet," because its whole body is covered with feet; it runs prodigiously fast; and its bite is dangerous, and even mortal if it gets into the ear.

There are in Persia all the several sorts of fowls which we have in Europe, but not in such great plenty; excepting, however, wild and tame pigeons, of which vast numbers are kept all over the kingdom, chiefly on account of their dung; which is the best manure for melons. It is a great diversion among the lower sort of people in town or country to catch pigeons, though it be forbidden: for this purpose they have pigeons so taught, that flying in one flock, they surround such wild ones as they find in the field, and bring them back with them to their masters. The partridges of this country are the largest and finest in the world, being generally of the size of our fowls. Geese, ducks, cranes, herons, and many other sorts of water fowl, are common here; as are likewise nightingales, which are heard all the year, but chiefly in the spring; martlets, which learn whatever words are taught them; and a bird called *noura*, which chatters incessantly, and repeats whatever it hears. Of birds of a larger size, the most remarkable is the pelican, by the Persians called *tacab*, i. e. "water-carrier;" and also *misc*, i. e. "sheep," because it is as large as one of these animals *. There are in Persia various birds of prey. Some of their falcons are the largest and finest in the world; the people take great pains to teach them to fly at game; the Persian lords being great lovers of falconry, and the king having generally 800 of this sort of birds, each of which has a person to attend it.

74 Mountains, rivers, and seas.

There is perhaps no country in the world which, generally speaking, is more mountainous than Persia; but many of them yield neither springs nor metals, and but few of them are shaded with trees. It is true some of the chief of them are situated on the frontiers, and serve as a kind of natural ramparts, or bulwarks, to this vast empire. Among the latter are the mountains of Caucasus and Ararat, sometimes called the *mountains of Daghestan*, which fill all the space between the Euxine and Caspian seas: those called *Taurus*, and the several branches thereof, run through Persia from Natolia to India, and fill all the middle of the country.

As to rivers, except the Araxes, which rises in the mountains of Armenia, and falls into the Kur or Cyrus before it reaches the Caspian sea, there is not one navigable stream in this country. The Oxus divides Persia on the north-east from Usbeck Tartary. The Indus also may now be reckoned among the rivers of Persia, as the provinces lying to the west of that river are now in possession of that crown: this river is said to run a course of more than 1000 miles, and overflows all the low grounds in April, May, and June.

The seas on the south of Persia are, the gulf of Persia or Bassora, the gulf of Ormus, and the Indian ocean. The only sea on the north is the Caspian or Hyrcanian sea; which is more properly a lake, having no communication with any other sea. These seas, together with the lakes and rivers, supply Persia with plenty of fish. The Caspian sea contains very fine fish on one side; and the Persian gulf on the other is believed to have more fish than any other sea in the world. On the coasts of this gulf is taken a sort of fish, for which they have no particular name; its flesh is of a red colour, very delicious, and some of them weigh 200 or 300 pounds. The river fish are chiefly barbels; but far from being good. Those of the lakes are carps and shads. In the river at Spauhawn are a great number of crabs, which crawl up the trees, and live night and day under the leaves, whence they are taken; and are esteemed very delicious food.

75 Islands, &c. in the Persian gulf.

In his voyage from Gombroon up the Persian gulf, Mr Ives makes mention of several islands, named Kisme, Polloar, Kyes, Inderabie, Shittewar, and Busheel. Some of these were quite barren; on others there were a few trees and bushes, with little fishing towns, and a few small vessels lying along shore. The date trees were thinly scattered among the hills; but though a small portion of green might here and there be discovered, yet such was the barrenness of these islands in general, that it was for some time a matter of surprise how sheep and goats could possibly subsist upon them. On closer examination, however, it was found, that the soil produced a kind of small leaved juicy mallows, on which these animals principally feed. The Persian coast, as they sailed along, afforded a most romantic prospect, appearing at first to be one continued rock, rent and torn asunder by earthquakes; but it was afterwards discovered, that some part of it was only sand hardened by the rains and sun.

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* See *Pelicanus*, Ornithology *Index*.

Narban Point terminates in a long and low piece of land, which runs off into the gulf from the foot of the Persian hills. Between this point and the main land is a channel, in which a ship of 900 tons burden might easily ride. The Portuguese had formerly a settlement here, the remains of which are still to be seen. A large river empties itself into the sea at this place; and Mr Ives observes, that "Providence seems here to have allotted a spot of ground amidst unhospitable rocks and deserts, capable of affording the kind production of vegetables for man and beast." The adjacent country is subject to the Arabs.

Through all the Persian gulf, Mr Ives remarks that the spring water on the islands is much better than that on the continent; and the water nearest the sea on the islands has greatly the advantage over that which is found in the middle parts. This holds good, however, only in those parts which are near the sea; for about 12 miles up the country, both on the Persian and Arabian side of the gulf, the water is very good. At the island called Bareen or Baharen, divers go down to the bottom of the sea, at certain known depths, and come up again with their vessels filled with fresh water. This fresh water is found in holes or little natural wells, some fathoms below the surface of the sea. The Arabs have certain marks on the island to teach them where to dive for the fresh water. Mr Ives was assured by an Arabian merchant, that he himself had discovered a spring upon the shore, by which one of these wells is served. He put into this spring a bit of heavy stick; and in two or three days an Arabian diver brought it to him again from the bottom of one of these holes.

76
Trade.

The English and other nations, trade with the Persians several ways, particularly by the gulf of Ormus at Gombroon, and by the way of Turkey. A trade also was not many years since opened by the English with Persia through Russia and the Caspian sea; but that is now discontinued, having been prohibited by the court of Russia, who were apprehensive that the English would teach the Persians to build ships, and dispute the navigation of the Caspain sea with them. The principal commodities and manufactures of Persia are raw and wrought silks, mohair camblets, carpets, leather; for which, and some others, the European merchants enchange chiefly woollen manufactures; but the trade is carried on altogether in European shipping, the Persians have scarce any ships of their own, and the Russians the sole navigation of the Caspian sea. There is not a richer or more profitable trade in the world, than that which is carried on between Gombroon and Surat in the East Indies; and the English East India Company frequently let out their ships to transport the merchandise of the Banians and Armenians from Persia to India. The shah or sovereign of Persia, is the chief merchant; and he usually employs his Armenian subjects to traffic for him in every part of the world. The king's agents must have the refusal of all merchandise, before his subjects are permitted to trade. It is computed that Persia produces yearly upwards of 22,000 bales of silk, chiefly in the provinces of Ghilan and Mazanderan, each bale weighing 263 pounds. Vast quantities of Persian silk used to be imported into Europe, especially by the Dutch, English, and Russians, before the civil wars began. The goods exported from Persia to India are, tobacco, all sorts of fruits, pickled and preserved, especially dates, marmalade, wines, distilled waters, horses, Persian feathers, and Turkey leather of all sorts and colours, a great quantity whereof is also exported to Muscovy and other European countries. The exports to Turkey are, tobacco, galls, thread, goats hair, stuffs, mats, box-work, and many other things. As there are no posts in the east, and trading by commission with the use of bills of exchange, is little known, traffic must proceed in a very awkward heavy manner, in comparison of that of Europe.

77
Money.

The most current money of Persia are the abassees, worth about 1s. 4d. sterling; they are of the finest silver. An abassee is worth two mahmoudes; a mahmoude, two shahees; and a shahee, ten single or five double casbeghes; these last pieces are of brass, the others of silver; for gold is not current in trade. The shahees are not very common; but mahmoudes and casbeghes are current everywhere. Horses, camels, houses, &c. are generally sold by the toman, which is an imaginary coin, worth 200 shahees, or 50 abassees; and they usually reckon their estates that way. Such a one, they say, is worth so many tomans, as we say pounds in England.

78
Government.

Persia is an absolute monarchy, the lives and estates of the people being entirely at the disposal of their prince. The king has no council established, but is advised by such ministers as are most in favour; and the resolutions taken among the women of the haram frequently defeat the best laid designs. The crown is hereditary, excluding only the females. The sons of a daughter are allowed to inherit. The laws of Persia exclude the blind from the throne; which is the reason that the reigning prince usually orders the eyes of all the males of the royal family, of whom he has any jealousy, to be put out. The king has generally a great many wives, which it would be death for any one besides the eunuchs, who have the superintendance of them, to look at, or even see by accident; wherefore, when he travels, notice is given to all men to quit the road, nay their very houses, and to retire to a great distance.

The prime minister is called *attemaet doulet*, which signifies the director of the empire, and also *vizir azem*, or the great supporter of the empire; as he alone almost sustains the whole weight of the administration. This minister's chief study is to please his master, to secure to himself an ascendant over his mind, and to avoid whatever may give him any uneasiness or umbrage. With this view, he never fails to flatter him, to extol him above all the princes upon earth, and to throw a thick veil over every thing that might help to open his eyes, or discover to him the weakness of the state. He even takes particular care to keep the king in utter ignorance; to hide from him, or at least to soften, all unwelcome news; and, above all, to exalt immoderately every the least advantage he obtains over his enemies. As he takes these methods, which indeed are and must be taken, more or less, by the ministers of every despotic prince, to secure the favour and confidence of his master; so the inferior officers and governors of provinces are obliged to employ all the means in their power to secure the prime minister's, they depending no less upon him than he does upon the king.

There is a gradation of despotism and slavery, down from the prime minister to the lowest retainer to the court, or dependent on the government. Children are sometimes in Persia required by the king to cut off the ears and nose, and even to cut the throats of their parents; and these orders cannot be objected to, without endangering their own lives. Indeed their baseness and mercenariness are such, that they will perpetrate such atrocious deeds without the least scruple or difficulty, when they have a promise or expectation of possessing their posts. The prime ministers, notwithstanding the precarious footing on which they stand, in effect of their abilities or good fortune, sometimes continue in their employments during life, or, if removed are only banished to some city, where they are allowed to spend the remainder of their days in a private station.

Next to the prime minister are the nadir, or grand-master of the househould; the mehter, or groom of the chambers, who is always a white eunuch; the mirakbor bashe, or master of the horse; the mir-shikar bashe, or great huntsman and falconer; the divanbeggi, or chief justice, to whom there lies an appeal from the degora, or the lieutenant of police, in every town; the vacka nuviez, or recorder of events, or first secretary of state; the muslau-she-elmenaleck, or master of the accounts and finances of the kingdom; the numes humbashes, or the king's chief physicians; the shickada-fibashe, or inspector of the palace, and regulator of rank at court; and the khans, or governors of provinces, under whom are other governors, called *soltans*, appointed also by the king.

Civil matters are all determined by the cazi, and ecclesiastical ones (particularly divorces) by the sheick-el-selleum, or head of the faith; an officer answering to the mufti among the Turks; under him are the sheick-el-selom, and cadi, who decide in all matters of religion, and make all contracts, testaments, and other public deeds, being appointed by the king in all the principal towns; and next to these are the pichnamas, or directors of the prayers; and the moullahs, or doctors of the law.

Justice is carried on in Persia in a very summary manner; the sentence, whatever it may be, being always put into execution on the spot. Theft is generally punished with the loss of nose and ears; robbing on the road, by ripping up the belly of the criminal, in which situation he is exposed upon a gibbet in one of the most public parts of the city, and there left until he expires in torment.

There is no nobility in Persia, or any respect shown to a man on account of his family, except to those who are of the blood of their great prophet or patriarchs; but every man is esteemed according to the post he possesses; and when he is dismissed, he loses his honour, and he is no longer distinguished from the vulgar.

With respect to the forces of Persia, their two bodies, called the *Kortshies* and *Goulans*, that serve on horseback, are well kept and paid, and may amount, the former to about 22,000, and the latter to about 18,000. The Kortshies are descended from an ancient but foreign race; and the Goulans are either Georgian renegadoes or slaves, or the children of slaves of all nations. The infantry, called *Tangtchies*, are picked out from among the most robust and vigorous of the peasants, and compose a body of 40,000 or 50,000. The Persians have few fortified towns, and had no ships of war, till Kouli Khan built a royal navy, and among them had a man of war of 80 guns; but since the death of that usurper, we bear no more of their fleet.

The arms of the king of Persia are a lion couchant, looking at the sun as he rises over his back. His usual title is *Shaw* or *Patshaw*, the "disposer of kingdoms." They add also to the king's titles those of *sultan*, and *chan* or *cham*, which is the title of the Tartar sovereigns. To acts of state the Persian monarch does not subscribe his name; but the grant runs in this manner, viz. *This act, or edict, is given by him whom the univers obeys.*

The ancient Persians are known to have been exceedingly voluptuous and effeminate. After the conquest o the empire by Alexander, the Greek discipline and martial spirit being in part communicated to them, they became much more formidable; and hence the Parthian were found to be a match not only for the Syro-Macedonian princes, but even for the Romans. Of thei manners we know little or nothing, but that to their valour and military skill they joined in a surprising degre all the luxury and dissipation of the ancient Persians

The modern Persians, like the Turks, plundering a the adjacent nations for beauties to breed by, are men o a good stature, shape, and complexion; but the Gaures or ancient Persians, are homely, ill-shaped, and clumsy with a rough skin, and olive complexions. In som provinces, not only the complexions but the constitution of the inhabitants, suffer greatly by the extreme hea and unwholesomeness of the air. The Persian women too, are generally handsome and well-shaped, but muc inferior to those of Georgia and Circassia. The me wear large turbans on their heads, some of them ver rich, interwoven with gold and silver; a vest, girt wit a sash; and over it a loose garment, something shorter with sandals, or slippers, on their feet. When the ride, which they do every day, if it be but to a house i the same town, they wear pliant boots of yellow leather; the furniture of their horses is extremely rich, an the stirrups generally of silver: whether on horsebac or on foot, they wear a broadsword and a dagger in thei sash. The dress of the women does not differ much fro that of the men; only their vests are longer, and the wear stiffened caps on their heads, and their hair dow

With respect to outward behaviour, says an intelligent traveller, "The Persians are certainly the Parisians of the East. Whilst a rude and insolent demeanou peculiarly marks the character of the Turkish nation towards foreigners and Christians, the behaviour of th Persians would, on the contrary, do honour to the mos civilized nations: they are kind, courteous, civil, an obliging, to all strangers, without being guided by thos religious prejudices so very prevalent in every other Mahometan nation; they are fond of inquiring after th manners and customs of Europe, and in return very readily afford any information in respect to their own country. The practice of hospitality is with them so gran a point, that a man thinks himself highly honoured i you will enter his house and partake of what the famil affords; whereas, going out of a house without smokin a calean, or taking any other refreshment, is deemed i Persia a high affront."

Their usual drink is water and sherbet, as in othe Mahometan countries, wine being prohibited; but o all Mahometan nations they pay the least regard to thi prohibition. Many of them drink wine publicly, and al

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most all of them in private (excepting those who have performed the pilgrimage to Mecca, and ecclesiastics): they also are very liable to be quarrelsome when inebriated, which is often attended with fatal consequences. They eat opium, but in much less quantities than the Turks; and indeed in every thing they say or do, eat or drink, they make a point to be as different from this nation as possible, whom they detest to a man, beyond measure; esteeming Jews and Christians superior to them, and much nearer to salvation.

80 Anecdotes of their religion.

Every one knows, that the religion of the Persians is Mahometan; and that they are of the sect of Ali, for whom they entertain the most extravagant veneration. Mr Francklin heard one of his guides on the road reprove another for the expression *O God! O Ali!* "No, no (said his zealous companion), *Ali first, God second!*" This attachment is the source of their hatred to the Turks, and of many strange customs among themselves, which we have not room to enumerate; a few, however, must be mentioned.

"Their mode of living is as follows: They always rise at daybreak, in order to perform their devotions. Their first prayer is denominated *numaz soobh*, or the morning prayer; it is said before sunrise, after which they eat a slight meal called *nàshta*, or breakfast; this consists of grapes, or any other fruits of the season, with a little bread and cheese made of goats milk; they afterwards drink a cup of very strong coffee without milk or sugar; then the calean or pipe is introduced. The Persians, from the highest to the lowest ranks, all smoke tobacco.

"Their second hour of prayer is called *numaz zòhur*, or mid-day prayer, and is always repeated when the sun declines from the meridian. Their dinner, or *chàsht*, which is soon after this prayer, consists of curds, bread, and fruits of various kinds; animal food not being usual at this meal.

"The third hour of prayer is called *numaz àsur*, or the afternoon prayer, said about four o'clock.

"The fourth hour of prayer is *numaz shàm*, or evening prayer, which is said after sunset; when this is finished, the Persians eat their principal meal, called *shàmi* or supper. This generally consists of a pilau, dressed with rich meat sauces, and highly seasoned with various spices: sometimes they eat *kibaàb* or roast meat. When the meal is ready, a servant brings notice thereof, and at the same time presents a ewer and water; they then wash their hands, which is an invariable custom with the Persians both before and after eating. They eat very quick, conveying their food to their mouths with their fingers; the use of knives and forks being unknown in Persia. Sherbets of different sorts are introduced, and the meal concludes with a desert of delicious fruits. The supper being finished, the family sit in a circle, and entertain each other by relating pleasant stories (of which they are excessively fond), and also by repeating passages from the works of their most favourite poets, and amusing themselves at various kinds of games. The fifth and last prayer is styled *numaz akhir*, the last prayer; or sometimes *numaz shèb*, or the night prayer, repeated about an hour after supper."

81 Remarkable law respecting marriage.

The most remarkable law among the Persians respects marriage. A man may divorce his wife when he chooses, without assigning any other reason for the divorce than that it is his pleasure. If he should change his mind, he may again marry her, divorce her a second time, and a third time marry her; but here this privilege stops. No man is allowed to marry the woman whom he has thrice divorced. A widow is obliged to mourn four months for her deceased husband before she can be married to another; but a concubine may form a new connection the instant that her keeper expires.

82 Ceremony of naming their children.

At the naming of children in Persia, Mr Francklin informs us that the following ceremony is observed: "The third or fourth day after the child is born, the friends and relations of the woman who has lain-in assemble at her house, attended by music and dancing girls hired for the occasion; after playing and dancing some time, a mullah or priest is introduced, who, taking the child in his arms, demands of the mother what name she chooses the infant should be called by; being told, he begins praying, and after a short time applies his mouth close to the child's ear, and tells him distinctly three times (calling him by name) to remember and be obedient to his father and mother, to venerate his Koran and his prophet, to abstain from those things which are unlawful, and to practise those things which are good and virtuous. Having repeated the Mahometan profession of faith, he then redelivers the child to his mother; after which the company are entertained with sweetmeats and other refreshments, a part of which the females present always take care to carry away in their pockets, believing it to be the infallible means of their having offspring themselves."

83 Intellectual excellence.

The Persians excel more in poetry than any other sort of literature; and astrologers are now in as great reputation in Persia as the magi were formerly. Their books are all manuscripts, the art of printing having not yet been introduced among them: they excel indeed in writing, and have eight different hands. They write from the right hand to the left, as the Arabs do. In their short hand, they use the letters of the alphabet; and the same letters differently pointed, will have 20 different significations. In short, the Persians are born with as good natural parts as any people in the East, but make a bad use of them; being great dissemblers, cheats, liars, and flatterers, and having a strong propensity to voluptuousness, luxury, idleness, and indolence; vices indeed to which the Asiatics in general are much addicted. See PERSIA, SUPPLEMENT.

PERSIAN wheel. See HYDRODYNAMICS.

PERSICA, the PEACH, is by Linnæus referred to the same class and genus with amygdalus. There is a great variety of peach trees planted in the gardens, some of which are preserved only for the beauty of their flowers, but most of them for the sake of the fruit. Of those remarkable for the beauty of their flowers the principal are, 1. The vulgaris, or common peach-tree, with double flowers, which is a very great ornament in gardens, producing very large double flowers of a beautiful red or purple colour, and growing to a considerable size. 2. The humilis, or dwarf-almond. 3. The africana, or double-flowering dwarf-almond. These two reach not above the height of three or four feet, though their flowers are of equal beauty with the former.

Of the peach-trees cultivated for the sake of their fruit there is a great number. They are raised from the stones of the fruit, which should be planted in autumn on a bed of light dry earth, about three inches deep and four inches asunder. In the winter the beds should be covered with mulch to protect them from the frost. In this bed they should remain for a year; when they are to be taken up and planted in a nursery, where they are to remain one or two years; after which they must be removed to the places where they are to continue.

PERSICARIA. See POLYGONUM, BOTANY *Index*.

PERSICUS SINUS, in *Ancient Geography*, (Mela, Pliny); a part of the sea which the Romans called *Mare Rubrum*, and the Greeks *Mare Erythræum;* washing Arabia Felix on the east, between which and Carmania, entering into the land, it washes Persia on the south. Its large mouth consists of straight sides, like a neck, and then the land retiring equally a vast way, and the sea surrounding it in a large compass of shore, there is exhibited the figure of a human head (Mela). Theophrastus calls this bay *Sinus Arabicus*, a name it equally claims with *Persicus*, only for distinction sake *Persicus* is appropriated to it by others.

PERSIMON See DIOSPYROS, BOTANY *Index*.—From the persimon is made a very palatable liquor in the following manner: As soon as the fruit is ripe, a sufficient quantity is gathered, which is very easy, as each tree is well stocked with them. These persimon apples are put into a dough of wheat or other flour, formed into cakes, and put into an oven, in which they continue till they are quite baked and sufficiently dry, when they are taken out again: then, in order to brew the liquor, a pot full of water is put on the fire, and some of the cakes are put in: these become soft by degrees as the water grows warm, and crumble in pieces at last; the pot is then taken from the fire, and the water in it well stirred about, that the cakes may mix with it: this is then poured into another vessel, and they continue to steep and break as many cakes as are necessary for a brewing: the malt is then infused, and they proceed as usual with the brewing. Beer thus prepared is reckoned much preferable to other beer. They likewise make brandy of this fruit in the following manner: having collected a sufficient quantity of persimons in autumn, they are altogether put into a vessel, where they lie for a week till they are quite soft: then they pour water on them, and in that state they are left to ferment of themselves, without promoting the fermentation by any addition. The brandy is then made in the common way, and is said to be very good, especially if grapes (in particular of the sweet sort), which are wild in the woods, be mixed with the persimon fruit. Some persimons are ripe at the end of September, but most of them later, and some not before November and December, when the cold first overcomes their acrimony. The wood of this tree is very good for joiners instruments, such as planes, handles to chisels, &c. but if after being cut down it lies exposed to sunshine and rain, it is the first wood which rots, and in a year's time there is nothing left but what is useless. When the persimon trees get once into a field, they are not easily got out of it again, as they spread much.

PERSIS, a Roman lady, whom St Paul salutes in his epistle to the Romans (xvi. 12.), and whom he calls his beloved sister. He says she has laboured much for the Lord, and still labours. Nothing else of her life is come to our knowledge, nor do we know that she is honoured by any church; which is something singular.

PERSIUS FLACCUS, AULUS, a Latin poet in the reign of Nero, celebrated for his satires. He was born, according to some, at Volterra in Tuscany; and according to others, at Tigulia, in the gulf Della Specia, in the year 34. He was educated till 12 years old at Volterra; and afterwards continued his studies at Rome under Palæmon the grammarian, Virginius the rhetorician, and Cornutus the Stoic philosopher, who contracted a friendship for him. Persius consulted that illustrious friend in the composition of his verses. Lucian also studied with him under Cornutus; and appeared so charmed with his verses, that he was incessantly breaking out into acclamations at the beautiful passages in his satires: an example rarely seen in poets of equal rank. He was a steady friend, a good son, an affectionate brother and parent. He was chaste, meek, and modest: which shows how wrong it is to judge of a man's morals by his writings; for the satires of Persius are not only licentious, but sharp and full of bitterness. He wrote but seldom; and it was some time before he applied himself regularly to it.

Persius was of a weak constitution, and troubled with a bad stomach, which was the cause of his death in the 30th year of his age. Six of his satires remain; in their judgments of which the critics have been much divided, excepting as to their obscurity, Persius being indeed the most obscure of all the Latin poets. As a poet, he is certainly inferior to Horace and Juvenal; and all the labours of Isaac Causabon, who has written a most learned and elaborate commentary upon him, cannot make him equal to either of them as a satirist, though in virtue and learning he exceeded them both. He was a professed imitator of Horace; yet had little of Horace's wit, ease, and talent at ridicule. His style is grand, figurative, poetical, and suitable to the dignity of the Stoic philosophy: and hence he shines most in recommending virtue and integrity: here it is that satire becomes him. He was too grave to court the muses with success: but he had a great soul, susceptible of noble sentiments, which give a grace to but indifferent poetry. His cotemporaries thought highly of him. Quintilian allows, that Persius, although he wrote but one book of satires, acquired a great deal of true glory, *Multum et veræ gloriæ quamvis uno libro Persius meruit:* and Martial says much the same thing, *Sæpius in libro memoratur Persius uno*, &c.

PERSON, an individual substance of a rational intelligent nature. Thus we say, an ambassador represents the person of his prince; and that, in law, the father and son are reputed the same person.

The word *person*, *persona*, is thought to be borrowed *à personando*, from personating or counterfeiting; and is supposed to have first signified a mask: because, as Boethius informs us, *in larva concava sonus volvatur;* and hence the actors who appeared masked on the stage were sometimes called *larvati* and sometimes *personati*. He likewise says, that as the several actors represented each a single individual person, viz. Oedipus, or Chremes, or Hecuba, or Medea; for this reason, other people, who were at the same time distinguished by something in their form, character, &c. whereby they might be known, came likewise to be called by the Latins *personæ*, and by the Greeks πρόσωπα. Again, as actors rarely represented any but great and illustrious characters, the word came at length to import the mind, as being that whose dispositions constitute the character. And thus men, angels, and even God himself, were called *persons*. Things merely corporeal, as a stone, a plant, or a horse, were called *hypostases* or *supposita*, but never *persons*. Hence the learned suppose, that the same name *person* came to be used to signify some dignity, whereby a *person* is distinguished from another; as a father, husband, judge, magistrate, &c. In this sense we are to understand that of Cicero: "Cæsar never speaks of Pompey, but in terms of honour and respect: he does many hard and injurious things, however, against his person."

Person we have already defined to mean an individual substance of a reasonable nature. Now a thing may be individual two ways: 1. Logically, because it cannot be predicated of any other; as Cicero, Plato, &c. 2. Physically; in which sense a drop of water, separated from the ocean, may be called an individual. Person is an individual nature in each of these senses; logically, according to Boethius, because *person* is not spoken of universals, but only of singulars and individuals; we do not say the *person* of an animal or a man, but of Cicero and Plato: and physically, since Socrates's hand or foot are never considered as persons. This last kind of individual is denominated two ways: positively, when the person is said to be the whole principle of acting; for to whatever thing action is attributed, that the philosophers call a *person*: and negatively, as when we say, with the Thomists, &c. that a person consists in this, that it does not exist in another as a more perfect being. Thus a man, though he consists of two different things, viz. body and spirit, is not two persons; because neither part of itself is a complete principle of action, but one person, since the manner of his consisting of body and spirit is such as constitutes one whole principle of action; nor does he exist in any other as a more perfect being; as, for example, Socrates's foot does in Socrates, or a drop of water in the ocean.

PERSON, in *Grammar*, a term applied to such nouns or pronouns as, being either prefixed or understood, are the nominatives in all inflections of a verb; or it is the agent or patient in all finite or personal verbs. See GRAMMAR.

PERSONAL, any thing that concerns, or is restrained to, the person: thus it is a maxim in ethics, that all faults are personal.

PERSONAL Action, in *Law*, is an action levied directly and solely against the person, in opposition to a real or mixed action. See ACTION.

PERSONAL Goods, or *Chattels*, in *Law*, signifies any moveable thing belonging to a person, whether alive or dead. See CHATTELS.

PERSONAL Identity. See METAPHYSICS, Part III. Chap. iii.

PERSONAL Verb, in *Grammar*, a verb conjugated in all the three persons; thus called in opposition to an impersonal verb, or that which has the third person only.

PERSONALITY, in the schools, is that which constitutes an individual a distinct person.

PERSONATÆ, is the name of the 40th order in Linnæus's Fragments of a Natural Method, consisting of a number of plants whose flowers are furnished with an irregular gaping or grinning petal, which in figure somewhat resembles the snout of an animal. The bulk of the genera of this natural order arrange themselves under the class and order didynamia angiospermia of the Sexual Method.

The rest, although they cannot enter into the artificial class just mentioned, for want of the classic character, the inequality of the stamina; yet, in a natural method, which admits of greater latitude, may be arranged with those plants which they resemble in their habit and general appearance, and particularly in the circumstances expressed in that title.

PERSONIFYING, or PERSONALIZING, the giving an inanimate being the figure, sentiments, and language of a person.

Dr Blair, in his Lectures on Rhetoric, gives this account of personification. "It is a figure, the use of which is very extensive, and its foundation laid deep in human nature. At first view, and when considered abstractly, it would appear to be a figure of the utmost boldness, and to border on the extravagant and ridiculous. For what can seem more remote from the track of reasonable thought, than to speak of stones and trees, and fields and rivers, as if they were living creatures, and to attribute to them thought and sensation, affections and actions? One might imagine this to be no more than childish conceit, which no person of taste could relish. In fact, however, the case is very different. No such ridiculous effect is produced by personification when properly employed; on the contrary, it is found to be natural and agreeable, nor is any very uncommon degree of passion required in order to make us relish it. All poetry, even in its most gentle and humble forms, abounds with it. From prose it is far from being excluded; nay, in common conversation, very frequent approaches are made to it. When we say, the ground *thirsts* for rain, or the earth *smiles* with plenty; when we speak of ambition's being *restless*, or a disease being *deceitful*; such expressions show the facility with which the mind can accommodate the properties of living creatures to things that are inanimate, or to abstract conceptions of its own forming.

"Indeed, it is very remarkable, that there is a wonderful proneness in human nature to animate all objects. Whether this arises from a sort of assimilating principle, from a propension to spread a resemblance of ourselves over all other things, or from whatever other cause it arises, so it is, that almost every emotion which in the least agitates the mind bestows upon its object a momentary idea of life. Let a man, by an unwary step, sprain his ankle, or hurt his foot upon a stone, and in the ruffled discomposed moment he will sometimes feel himself disposed to break the stone in pieces, or to utter passionate expressions against it, as if it had done him an injury. If one has been long accustomed to a certain set of objects, which have made a strong impression on his imagination; as to a house, where he has passed many agreeable years; or to fields, and trees, and mountains, among which he has often walked with the greatest delight; when he is obliged to part with them especially

Personifying.

cially if he has no prospect of ever seeing them again, he can scarce avoid having somewhat of the same feeling as when he is leaving old friends. They seem endowed with life. They became objects of his affection; and, in the moment of his parting, it scarce seems absurd to him to give vent to his feeling in words, and to take a formal adieu.

"So strong is that impression of life which is made upon us, by the more magnificent and striking objects of nature especially, that I doubt not in the least of this having been one cause of the multiplication of divinities in the heathen world. The belief of dryads and naiads, of the genius of the wood and the god of the river, among men of lively imaginations, in the early ages of the world, easily arose from this turn of mind. When their favourite rural objects had often been animated in their fancy, it was an easy transition to attribute to them some real divinity, some unseen power or genius which inhabited them, or in some peculiar manner belonged to them. Imagination was highly gratified, by thus gaining somewhat to rest upon with more stability; and when belief coincided so much with imagination, very slight causes would be sufficient to establish it.

"From this deduction may be easily seen how it comes to pass that personification makes so great a figure in all compositions where imagination or passion have any concern. On innumerable occasions it is the very language of imagination and passion; and therefore deserves to be attended to, and examined with peculiar care. There are three different degrees of this figure, which it is necessary to remark and distinguish, in order to determine the propriety of its use. The first is, when some of the properties or qualities of living creatures are ascribed to inanimate objects; the second, when those inanimate objects are introduced as acting like such as have life; and the third, when they are represented either as speaking to us, or as listening to what we say to them."

The ingenious professor goes on to investigate the nature of personification at considerable length. We shall give his caution for the use of it in prose compositions, in which he informs us this figure requires to be used with great moderation and delicacy. "The same liberty is not allowed to the imagination there as in poetry. The same assistances cannot be obtained for raising passion to its proper height by the force of numbers and the glow of style. However, addresses to inanimate objects are not excluded from prose; but have their place only in the higher species of oratory. A public speaker may on some occasions very properly address religion or virtue; or his native country, or some city or province, which has suffered perhaps great calamities, or been the scene of some memorable action. But we must remember, that as such addresses are among the highest efforts of eloquence, they should never be attempted unless by persons of more than ordinary genius: for if the orator fails in his design of moving our passions by them, he is sure of being laughed at. Of all frigid things, the most frigid are the awkward and unseasonable attempts sometimes made towards such kinds of personification, especially if they be long continued. We see the writer or speaker toiling and labouring to express the language of some passion which he neither feels himself nor can make us feel. We remain not only cold but frozen; and are at full leisure to criticise on the ridiculous figure which the personified object makes, when we ought to have been transported with a glow of enthusiasm. Some of the French writers, particularly Bossuet and Flechier, in their sermons and funeral orations, have attempted and executed this figure, not without warmth and dignity. Their works are exceedingly worthy of being consulted for instances of this and of several other ornaments of style. Indeed the vivacity and ardour of the French genius is more suited to this bold species of oratory, than the more correct but less animated genius of the British, who in their prose works very rarely attempt any of the high figures of eloquence."

PERSPECTIVE.

PERSPECTIVE is the art of drawing on a plane surface true resemblances or pictures of objects, as the objects themselves appear to the eye from any distance and situation, real or imaginary.

It was in the 16th century that *Perspective* was revived, or rather reinvented. It owes its birth to painting, and particularly to that branch of it which was employed in the decorations of the theatre, where landscapes were properly introduced, and which would have looked unnatural and horrid if the size of the objects had not been pretty nearly proportioned to their distance from the eye. We learn from Vitruvius, that Agatharchus, instructed by Æschylus, was the first who wrote upon this subject; and that afterwards the principles of the art were more distinctly taught by Democritus and Anaxagoras, the disciples of Agatharchus. Of the theory of this art, as described by them, we know nothing; since none of their writings have escaped the general wreck that was made of ancient literature in the dark ages of Europe. However, the revival of painting in Italy was accompanied with a revival of this art.

The first person who attempted to lay down the rules of perspective was Pietro del Borgo, an Italian. He supposed objects to be placed beyond a transparent tablet, and endeavoured to trace the images which rays of light, emitted from them, would make upon it. But we do not know what success he had in this attempt, because the book which he wrote upon the subject is not now extant. It is, however, very much commended by the famous Egnazio Dante; and, upon the principles of Borgo, Albert Durer constructed a machine, by which he could trace the perspective appearance of objects.

Balthazar Perussi studied the writings of Borgo, and endeavoured to make them more intelligible. To him we owe the discovery of points of distance, to which all lines that make an angle of 45 degrees with the ground-line are drawn. A little time after, Guido Ubalni, another Italian, found that all the lines that are parallel to one another, if they be inclined to the ground-line, converge to some point in the horizontal line; and that through this point also, a line drawn from the eye, parallel to them, will pass. These principles put together enabled him to make out a pretty complete theory of perspective.

Great improvements were made in the rules of perspective by subsequent geometricians; particularly by Professor Gravesende, and still more by Dr Brooke Taylor, whose principles are in a great measure new, and far more general than any before him.

In order to understand the principles of perspective, it will be proper to consider the plane on which the representation is to be made as transparent, and interposed between the eye of the spectator and the object to be represented. Thus, suppose a person at a window looks through an upright pane of glass at any object beyond it, and, keeping his head steady, draws the figure of the object upon the glass with a black lead pencil, as if the point of the pencil touched the object itself; he would then have a true representation of the object in perspective as it appears to his eye.

In order to this two things are necessary: first, that the glass be laid over with strong gum-water, which, when dry, will be fit for drawing upon, and will retain the traces of the pencil: and, secondly, that he looks through a small hole in a thin plate of metal, fixed about a foot from the glass, between it and his eye, and that he keeps his eye close to the hole; otherwise he might shift the position of his head, and consequently make a false delineation of the object.

Having traced out the figure of the object, he may go over it again with pen and ink; and when that is dry, put a sheet of paper upon it, and trace it thereon with a pencil: then taking away the paper and laying it on a table, he may finish the picture by giving it the colours, lights, and shades, as he sees them in the object itself; and then he will have a true resemblance of the object.

To every person who has a general knowledge of the principles of optics, this must be self-evident: For as vision is occasioned by pencils of rays coming in straight lines to the eye from every point of the visible object, it is plain that, by joining the points in the transparent plane, through which all those pencils respectively pass, an exact representation must be formed of the object, as it appears to the eye in that particular position, and at that determined distance; and were pictures of things to be always first drawn on transparent planes, this simple operation, with the principle on which it is founded, would comprise the whole theory and practice of perspective. As this, however, is far from being the case, rules must be deduced from the sciences of optics and geometry for drawing representations of visible objects on opaque planes; and the application of these rules constitutes what is properly called the *art* of perspective.

Previous to our laying down the fundamental principles of this art, it may not be improper to observe, that when a person stands right against the middle of one end of a long avenue or walk, which is straight and equally broad throughout, the sides thereof seem to approach nearer and nearer to each other as they are further and further from his eye; or the angles, under which their different parts are seen, become less and less according as the distance from his eye increases; and if the avenue be very long, the sides of it at the farthest end will seem to meet: and there an object that would cover the whole breadth of the avenue, and be of a height equal to that breadth, would appear only to be a mere point.

Having made these preliminary observations, we now proceed to the practice of perspective, which is built upon the following.

(*Fundamental*) THEOREM I.

Plate CCCCX. fig. 1.

Let $abcd$ (fig. 1.) represent the ground-plan of the figure to be thrown into perspective, and $efgh$ the transparent plane through which it is viewed by the eye at E. Let these planes intersect in the straight line KL. Let B be any point in the ground-plan, and BE a straight line, the path of a ray of light from that point to the eye. This will pass through the plane $efgh$ in some point b; or B will be seen through that point, and b will be the picture, image, or representation of B.

If BA be drawn in the ground-plan, making any angle BAK with the common intersection, and EV be drawn parallel to it, meeting the picture-plane or perspective-plane in V, and VA be drawn, the point b is in the line VA so situated that BA is to EV as bA to bV.

For since EV and BA are parallel, the figure BA$b$VE$b$B is in one plane, cutting the perspective-plane in the straight line VA; the triangles BAb, EVb, are similar, and $BA : EV = bA : bV$.

Cor. 1. If B be beyond the picture, its picture b is above the intersection KL; but if B be between the eye and the picture, as at B′, its picture b' is below KL.

2. If two other parallel lines BA′, ES, be drawn, and A′, S, be joined, the picture of B is in the intersection of the lines AV and A′S.

3. The line BA is represented by bA, or bA is the picture of BA; and if AB be infinitely extended, it will be represented by AV. V is therefore called the *vanishing point* of the line AB.

4. All lines parallel to AB are represented by lines converging to V from the points where these lines intersect the perspective-plane; and therefore V is the vanishing point of all such parallel lines.

5. The pictures of all lines parallel to the perspective-plane are parallel to the lines themselves. Fig. 2.

6. If through V be drawn HVO parallel to KL, the angle EVH is equal to BAK. Fig. 1.

Remark. The proposition now demonstrated is not limited to any inclination of the picture-plane to the ground-plane; but it is usual to consider them as perpendicular to each other, and the ground-plane as horizontal. Hence the line KL is called the *ground-line*, and OH the *horizon line*; and OK, perpendicular to both, is called the *height of the eye*.

If ES be drawn perpendicular to the picture-plane, it will cut it in a point S of the horizon-line directly opposite to the eye. This is called the *point of sight*, or *principal point*.

7. The pictures of all vertical lines are vertical, and the pictures of horizontal lines are horizontal, because these lines are parallel to the perspective plane.

8. The point of sight S is the vanishing point of all lines perpendicular to the perspective plane.

The above proposition is a sufficient foundation for the whole practice of perspective, whether on direct or inclined pictures, and serves to suggest all the various practical constructions, each of which has advantages which suit particular purposes. Writers on the subject have either confined themselves to one construction, from an affectation of simplicity or fondness for system; or have multiplied precepts, by giving every construction for every example, in order to make a great book, and give the subject an appearance of importance and difficulty. An ingenious practitioner will avoid both extremes, and avail himself of the advantage of each construction as it happens to suit his purpose. We shall now proceed to the practical rules, which require no consideration of intersecting planes, and are all performed on the perspective plane by means of certain substitutions for the place of the eye and the original figure. The general substitution is as follows:

Let the plane of the paper be first supposed to be the ground-plan, and the spectator to stand at F
Fig. 3. (fig. 3.). Let it be proposed that the ground-plan is to be represented on a plane surface, standing perpendicularly on the line GKL of the plan, and that the point K is immediately opposite to the spectator, or that FK is perpendicular to GL: then FK is equal to the distance of the spectator's eye from the picture.

Now suppose a piece of paper laid on the plan with its straight edge lying on the line GL; draw on this paper KS perpendicular to GL, and make it equal to the height of the eye above the ground plan. This may be much greater than the height of a man because the spectator may be standing on a place much raised above the ground-plan. Observe also that KS must be measured on the same scale on which the ground-plan and the distance FK were measured. Then draw HSO parallel to GL. This will be a horizontal line, and (when the picture is set upright on GL) will be on a level with the spectator's eye, and the point S will be directly opposite to his eye. It is therefore called the *principal point*, or *point of sight*. The distance of his eye from this point will be equal to FK. Therefore make SP (in the line SK) equal to FK, and P is the projecting point or substitute for the place of the eye. It is sometimes convenient to place B above S, sometimes to one side of it on the horizontal line, and in various other situations; and writers, ignorant of, or inattentive to, the principles of the theory, have given it different denominations, such as *point of distance*, *point of view*, &c. It is merely a substitute for the point E in fig. 1. and its most natural situation is below, as in this figure.

The art of perspective is conveniently divided into ICHNOGRAPHY, which teaches how to make a perspective draught of figures on a plane, commonly called the ground-plan; and SCENOGRAPHY, which teaches how to draw solid figures, or such figures as are raised above this plan.

Fundamental PROB. I. *To put into perspective any given point of the ground-plan.*

First general construction.

From B and P (fig. 3.) draw any two parallel lines Fig. 3.
BA, PV, cutting the ground-line and horizon-line in A and V, and draw BP, AV, cutting each other in *b*; *b* is the picture of B.

For it is evident that BA, PV, of this figure are analogous to BA and EV of fig. 1. and that BA : PV = *b*A : *b*V.

If BA′ be drawn perpendicular to GL, PV will fall on PS, and need not be drawn. A′V will be A′S.—This is the most easy construction, and nearly the same with Ferguson's.

Second general construction.

Draw two lines BA, BA″, and two lines PV, PD, parallel to them, and draw AV, A″D, cutting each other in *b*: *b* is the picture of P by Cor. 2.—This construction is the foundation of all the rules of perspective that are to be found in the books on this subject. They appear in a variety of forms, owing to the ignorance or inattention of the authors to the principles. The rule most generally adhered to is as follows:

Draw BA (fig. 4.) perpendicular to the ground Fig. 4.
line, and AS to the point of sight, and set off Aβ equal to BA. Set off SD equal to the distance of the eye in the opposite direction from S that β is from A, where B and E of fig. 1. are on opposite sides of the picture; otherwise set them the same way. D is called the point of distance. Draw β D, cutting AS in *b*. This is evidently equivalent to drawing BA′ and PS perpendicular to the ground-line and horizon-line, and BA″ and PD (fig. 3.) making an angle of 45° with these lines, with the additional puzzle about the way of setting off A′A″ and SD, which is avoided in the con- Fig. 5.
struction here given.

This usual construction, however, by a perpendicular and the point of distance, is extremely simple and convenient; and two points of distance, one on each side of S, serve for all points of the ground plan. But the first general construction requires still fewer lines, if BA be drawn perpendicular to GL, because PV will then coincide with PS.

Third general construction.

Draw BA (fig 4.) from the given point B perpen- Fig. 4.
dicular to the ground-line, and AS to the point of sight. From the point of distance D set off D *d* equal to BA, on the same or the contrary sides as S, according as B is on the same or the contrary side of the picture as the eye. Join *d*, A, and draw D *b* parallel to *d* A. *b* is the picture of B. For SD, D *d*, are equal to the distances of the eye and given point from the picture, and SD : D *d* = *b* S : *b* A.

This construction does not naturally arise from the original lines, but is a geometrical consequence from their position and magnitude; and it is of all others the most generally convenient, as the perpendicular distance of any number of points may be arranged along SD without confusion, and their direct situations transferred to the ground-line by perpendiculars such as BA; and nothing is easier than drawing parallels, either by a parallel ruler or a bevel square, used by all who practise drawing.

Fig. 5. **Prob. 2.** *To put any straight line* BC (fig. 5.) *of the ground plan in perspective.*

Find the pictures *b*, *c*, of its extreme points by any of the foregoing constructions, and join them by the straight line *b c*.

Perhaps the following construction will be found very generally convenient.

Produce CB till it meet the ground-line in A, and draw PV parallel to it; join AV, and draw PB, PC, cutting AV in *b*, *c*. V is its vanishing point, by Cor. 3. of the fundamental theorem.

It must be left to the experience and sagacity of the drawer to select such circumstances as are most suitable to the multiplicity of the figures to be drawn.

Prob. 3. *To put any rectilineal figure of the ground-plan in perspective.*

Put the bounding lines in perspective, and the problem is solved.

The variety of constructions of this problem is very great, and it would fill a volume to give them all. The most generally convenient is to find the vanishing points of the bounding lines, and connect these with the points of their intersection with the ground line. Fig. 6. For example, to put the square ABCD (fig. 6.) into perspective.

Draw from the projecting point PV, PW, parallel to AB, BC, and let AB, BC, CD, DA, meet the ground-line, in α, κ, δ, β, and draw α V, δ V, κ W, β W, cutting each other in *a b c d*, the picture of the square ABCD. The demonstration is evident.

This construction, however, runs the figure to great distances on each side of the middle line, when any of the lines of the original figure are nearly parallel to the ground-line.

Fig. 7. The following construction (fig. 7.) avoids this inconvenience.

Let D be the point of distance. Draw the perpendiculars A α, B β, C κ, D δ, and the lines A *e*, B *f*, C *g*, D *h*, parallel to PD. Draw S α, S β, S κ, S δ, and D *e*, D *f*, D *g*, D *h*, cutting the former in *a*, *b*, *c*, *d*, the angles of the picture.

It is not necessary that D be the point of distance, only the lines A *e*, B *f*, &c. must be parallel to PD.

Remark. In all the foregoing constructions the necessary lines (and even the finished picture) are frequently confounded with the original figure. To avoid this great inconvenience, the writers on perspective direct us to transpose the figure; that is, to transfer it to the other side of the ground-line, by producing the perpendiculars A α, B β, C κ, D δ, till α A′, β B′, &c. are respectively equal to A α, B β, &c.; or, instead of the original figure, to use only its transposed substitute A′B′C′D′. This is an extremely proper method. But in this case the point P must also be transposed to P′ above S, in order to retain the first or most natural and simple construction, as in fig. 8; where it is evident, that when Fig. 8. $BA=AB'$, and $SP=SP'$, and B′P′ is drawn, cutting AS in *b*, we have $bA:bS=B'A:P'S,=BA:PS$, and *b* is the picture of B: whence follows the truth of all the subsequent constructions with the transposed figure.

Prob. 4. *To put any curvilineal figure on the ground-plan into perspective.*

Put a sufficient number of its points in perspective by the foregoing rules, and draw a curve line through them.

It is well known that the conic sections and some other curves, when viewed obliquely, are conic sections or curves of the same kind with the originals, with different positions and proportions of their principal lines, and rules may be given for describing their pictures founded on this property. But these rules are very various, unconnected with the general theory of perspective, and more tedious in the execution, without being more accurate than the general rule now given. It would be a useless affectation to insert them in this elementary treatise.

We come in the next place to the delineation of figures not in a horizontal plane, and of solid figures. For this purpose it is necessary to demonstrate the following

THEOREM II.

The length of any vertical line standing on the ground plane is to that of its picture, as the height of the eye to the distance of the horizon line from the picture of its foot.

Let BC (fig. 2) be the vertical line standing on B, Fig. 2. and let EF be a vertical line through the eye. Make BD equal to EF, and draw DE, CE, BE. It is evident that DE will cut the horizon line in some point *d*, CE will cut the picture plane in *c*, and BE will cut it in *b*, and that *b c* will be the picture of BC, and is vertical, and that BC is to *b c* as BD to *b d*, or as EF to *b d*.

Cor. The picture of a vertical line is divided in the same ratio as the line itself. For $BC:BM=bc:bm$.

Prob. 5. *To put a vertical line of a given length in perspective standing on a given point of the picture.*

Through the given point *b* (fig. 9.) of the picture, Fig. 9. draw S *b* A from the point of sight, and draw the vertical line AD, and make AE equal to the length or height of the given line. Join ES, and draw *b c* parallel to AD, producing *b c*, when necessary, till it cut the horizontal line in *d*, and we have $bc:bd,=AE:AD$, that is, as the length of the given line to the height of the eye, and *b d* is the distance of the horizon-line, from the point *b*, which is the picture of the foot of the line. Therefore (Theor. 2.) *b c* is the required picture of the vertical line.

This problem occurs frequently in views of architecture; and a compendious method of solving it would be particularly convenient. For this purpose, draw a vertical line XZ at the margin of the picture, or on a separate paper, and through any point V of the horizon-line draw VX. Set off XY, the height of the vertical-line, and draw VY. Then from any points *b*, *r*, on which it is required to have the pictures of lines equal to XY, draw *b s*, *r t*, parallel to the horizon-line, and draw the verticals *s u*, *t v*: these have the lengths required, which may be transferred to *b* and *r*. This, with the third general construction for the base points, will save all the confusion of lines which would arise from constructing each line apart.

PROB. 6. *To put any sloping line in perspective.*

From the extremities of this line, suppose perpendiculars meeting the ground plane in two points, which we shall call the base points of the sloping line. Put these base points in perspective, and draw, by last problem, the perpendiculars from the extremities. Join these by a straight line. It will be the picture required.

PROB. 7. *To put a square in perspective, as seen by a person not standing right against the middle of either of its sides, but rather nearly even with one of its corners.*

Fig. 10. In fig. 10. let ABCD be a true square, viewed by an observer, not standing at *o*, directly against the middle of its sides AD, but at O almost even with its corner D, and viewing the side AD under the angle AOD; the angle A *o* D (under which he would have seen AD from *o*) being 60 degrees.

Fig. 11. Make AD in fig. 11. equal to AD in fig. 10. and draw SP and O *o* parallel to AD. Then, in fig. 11. let O be the place of the observer's eye, and SO be perpendicular to SP; then S shall be the point of sight in the horizon SP.

Take SO in your compasses, and set that extent from S to P; then P shall be the true point of distance, taken according to the foregoing rules.

From A and D draw the straight lines AS and DS; draw also the straight line AP, intersecting DS in C.

Lastly, through the point of intersection C draw BC parallel to AD; and ABCD in fig. 11. will be a true perspective representation of the square ABCD in fig. 10. The point M is the centre of each square, and AMC and BMD are diagonals.

PROB. 8. *To put a reticulated square in perspective, as seen by a person standing opposite to the middle of one of its sides.*

Fig. 12. A reticulated square is one that is divided into several little squares, like net-work, as fig. 12. each side of which is divided into four equal parts, and the whole surface into four times four (or 16) equal squares.

Having divided this square into the given number of lesser squares, draw the two diagonals A *x* C and B *x* D.

Fig. 13. Make AD in fig. 13. equal to AD in fig. 12. and divide it into four equal parts, as A *e*, *e g*, *g i*, and *i* D.

Draw SP for the horizon, parallel to AD, and, through the middle point *g* of AD, draw OS perpendicular to AD and SP.—Make S the point of sight, and O the place of the observer's eye.

Take SP equal to SO, and P shall be the true point of distance.—Draw AS and DS to the point of sight, and AP to the point of distance, intersecting DS in C: then draw BC parallel to AD, and the outlines of the reticulated square ABCD will be finished.

From the division points *e*, *g*, *i*, draw the straight lines *e f*, *g h*, *i k*, tending towards the point of sight S; and draw BD for one of the diagonals of the square, the other diagonal AC being already drawn.

Through the points *r* and *s*, where these diagonals cut *e f* and *i k*, draw *l m* parallel to AD. Through the centre-point *x*, where the diagonals cut *g h*, draw *n o* parallel to AD.—Lastly, through the points *v* and *w*, where the diagonals cut *e f* and *i k*, draw *p q* parallel to AD; and the reticulated perspective square will be finished.

This square is truly represented, as if seen by an observer standing at O, and having his eye above the horizontal plane ABCD on which it is drawn; as if OS was the height of his eye above that plane: and the lines which form the small squares within it have the same letters of reference with those in fig. 12. which is drawn as it would appear to an eye placed perpendicularly above its centre *x*.

PROB. 9. *To put a circle in perspective.*

If a circle be viewed by an eye placed directly over its centre, it appears perfectly round, but if it be obliquely viewed, it appears of an elliptical shape. This is plain by looking at a common wine-glass set upright on a table.

Make a true reticulated square, as fig. 12. of the same diameter as you would have the circle; and setting one foot of the compasses in the centre *x*, describe as large a circle as the sides of the square will contain. Then, having put this reticulated square into perspective, as in fig. 13. observe through what points of the cross lines and diagonals of fig. 12. the circle passes; and through the like points in fig. 13. draw the ellipsis, which will be as true a perspective representation of the circle, as the square in fig. 13. is of the square in fig. 12. Fig. 12.

This is Mr Ferguson's rule for putting a circle in perspective; but the following rules by Wolf are perhaps more universal.

If the circle to be put in perspective be small, describe a square about it. Draw first the diagonals of the square, and then the diameters *h a* and *d e* (fig. 14.) Fig. 14. cutting one another at right angles; draw the straight lines *f g* and *b c* parallel to the diameter *d e*. Through *b* and *f*, and likewise *c* and *g*, draw straight lines meeting DE, the ground line of the picture in the points 3 and 4. To the principal point V draw the straight lines 1 V, 3 V, 4 V, 2 V, and to the points of distance L and K, 2 L and 1 K. Lastly, join the points of intersection, *a*, *b*, *d*, *f*, *h*, *g*, *e*, *c*, by the arcs *a b*, *b d*, *d f*, and *a b d f h g e c a* will be the circle in perspective.

If the circle be large so as to make the foregoing practice inconvenient, bisect the ground line AB, describing, from the point of bisection as a centre, the semicircle AGB (fig. 15.), and from any number of Fig. 15. points in the circumference C, F, G, H, I, &c. draw to the ground line the perpendiculars C 1, F 2, G 3, H 4, I 5, &c. From the points A, 1, 2, 3, 4, 5, B, draw straight lines to the principal point or point of sight V, likewise straight lines from B and A to the points of distance L and K. Through the common intersections draw straight lines as in the preceding case; and you will have the points *a*, *c*, *f*, *g*, *h*, *i*, *b*, representatives of A, C, F, G, H, I, B. Then join the points *a*, *c*, *f*, &c. as formerly directed, and you have the perspective circle *a c f g h i b i h g f c a*.

Hence it is apparent how we may put not only a circle but also a pavement laid with stones of any form in perspective. It is likewise apparent how useful the square is in perspective; for, as in the second case, a true square was described round the circle to be put in perspective, and divided into several smaller squares, so in this third case we make use of the semicircle only for the sake of brevity instead of that square and circle.

Prob. 10. *To put a reticuluted square in perspective as seen by a person not standing right against the middle of either of its sides, but rather nearly even with one of its corners.*

Fig. 16. In fig. 16. let O be the place of an observer, viewing the square ABCD almost even with its corner D.—Draw at pleasure SP for the horizon, parallel to AD, and make SO perpendicular to SP: then S shall be the point of sight, and P the true point of distance, if SP be made equal to SO.

Draw AS and DS to the point of sight, and AP to the point of distance, intersecting DS in the point C; then draw BC parallel to AD, and the outlines of the perspective square will be finished. This done, draw the lines which form the lesser squares, as taught in Prob. 8. and the work will be completed.—You may put a perspective circle in this square by the same rule as it was done in fig. 13.

Prob. 14. *To put a cube in perspective, as if viewed by a person standing almost even with one of its edges, and seeing three of its sides.*

Fig. 17. In fig. 17. let AB be the breadth of either of the six equal square sides of the cube AG; O the place of the observer, almost even with the edge CD of the cube, S the point of sight, SP the horizon parallel to AD, and P the point of distance taken as before.

Make ABCD a true square; draw BS and CS to the point of sight, and BP to the point of distance, intersecting CS in G.—Then draw FG parallel to BC, and the uppermost perspective square side BFGC of the cube will be finished.

Draw DS to the point of sight, and AP to the point of distance, intersecting DS in the point I: then draw GI parallel to CD; and, if the cube be an opaque one, as of wood or metal, all the outlines of it will be finished; and then it may be shaded as in the figure.

But if you want a perspective view of a transparent glass cube, all the sides of which will be seen, draw AH toward the point of sight, FH parallel to BA, and HI parallel to AD: then AHID will be the square base of the cube, perspectively parallel to the top BFGC; ABFH will be the square side of the cube, parallel to CGID, and FGIH will be the square side parallel to ABCD.

As to the shading part of the work, it is such mere children's play, in comparison of drawing the lines which form the shape of any object, that no rules need be given for it. Let a person sit with his left side toward a window, and he knows full well, that if any solid body be placed on a table before him, the light will fall on the left-hand side of the body, and the right-hand side will be in the shade.

Prob. 15. *To put any solid in perspective.*

Put the base of the solid, whatever it be, in perspective by the preceding rules. From each bounding point of the base, raise lines representing in perspective the altitude of the object; by joining these lines and shading the figure according to the directions in the preceding problem, you will have a scenographic representation of the object. This rule is general; but as its application to particular cases may not be apparent, it will be proper to give the following examples of it.

Prob. 16. *To put a cube in perspective as seen from one of its angles.*

Since the base of a cube standing on a geometrical plane, and seen from one of its angles, is a square seen from one of its angles, draw first such a perspective square: then raise from any point of the ground-line DE (fig. 18.) the perpendicular HI equal to the side of Fig. 18. the square, and draw to any point V in the horizontal line HR the straight lines VI and VH. From the angles *d*, *b*, and *c*, draw the dotted lines *d* 2 and *c* 1 parallel to the ground line DE. Perpendicular to those dotted lines, and from the points 1 and 2, draw the straight lines L 1 and M 2. Lastly, since HI is the altitude of the intended cube in *a*, L 1 in *c* and *b*, M 2 in *d*, draw from the point *a* the straight line *f a* perpendicular to *a* E, and from the points *b* and *c*, *b g* and *c e*, perpendicular to *b c* 1, and *a b d c* being according to rule, make *af*=HI, *bg*=*ec*=L 1, and *hd*=M 2. Then, if the points *g*, *h*, *e*, *f*, be joined, the whole cube will be in perspective.

Prob. 17. *To put a square pyramid in perspective, as standing upright on its base, and viewed obliquely.*

In fig. 19. let AD be the breadth of either of the Fig. 19. four sides of the pyramid ATCD at its base ABCD; and MT its perpendicular height. Let O be the place of the observer, S his point of sight, SE his horizon, parallel to AD and perpendicular to OS; and let the proper point of distance be taken in SE produced toward the left hand, as far from S as O is from S.

Draw AS and DS to the point of sight, and DL to the point of distance, intersecting AS in the point B. Then, from B, draw BC parallel to AD; and ABCD shall be the perspective square base of the pyramid.

Draw the diagonal AC, intersecting the other diagonal BD at M, and this point of intersection shall be the centre of the square base.

Draw MT perpendicular to AD, and of a length equal to the intended height of the pyramid: then draw the straight outlines AT, CT, and DT; and the outlines of the pyramid (as viewed from O) will be finished; which being done, the whole may be so shaded as to give it the appearance of a solid body.

If the observer had stood at *o*, he could have only seen the side ATD of the pyramid; and two is the greatest number of sides that he could see from any other place of the ground. But if he were at any height above the pyramid, and had his eye directly over its top, it would then appear as in fig. 20. and he Fig. 20. would see all its four sides E, F, G, H, with its top *t*, just over the centre of its square base ABCD; which would.

would be a true geometrical and not a perspective square.

Prob. 18. *To put two equal squares in perspective, one of which shall be directly over the other, at any given distance from it, and both of them parallel to the plane of the horizon.*

Fig. 21. In fig. 21. let ABCD be a perspective square on a horizontal plane, drawn according to the foregoing rules, S being the point of sight, SP the horizon (parallel to AD), and P the point of distance.

Suppose AD, the breadth of this square to be three feet; and that it is required to place just such another square EFGH directly above it, parallel to it and two feet from it.

Make AE and DH perpendicular to AD, and two thirds of its length: draw EH, which will be equal and parallel to AD; then draw ES and HS to the point of sight S, and EP to the point of distance P, intersecting HS in the point G: this done, draw FG parallel to EH; and you will have two perspective squares ABCD and EFGH, equal and parallel to one another, the latter directly above the former, and two feet distant from it; as was required.

By this method shelves may be drawn parallel to one another, at any distance from each other in proportion to their length.

Prob. 19. *To put a truncated pyramid in perspective.*

Let the pyramid to be put in perspective be quinquangular. If from each angle of the surface whence the top is cut off, a perpendicular be supposed to fall upon the base, these perpendiculars will mark the bounding-points of a pentagon, of which the sides will be parallel to the sides of the base of the pyramid, within which it is inscribed. Join these points, and the interior pentagon will be formed with its longest side parallel to the longest side of the base of the pyramid. From the ground line EH (fig. 22.) raise the perpendicular IH, and make it equal to the altitude of the intended pyramid. To any point V draw the straight lines IV and HV, and by a process similar to that in Prob. 16. determine the scenographical altitudes *a*, *b*, *c*, *d*, *e*. Connect the upper points *f*, *g*, *h*, *i*, *k*, by straight lines; and draw *l k*, *f m*, *g n*, and the perspective of the truncated pyramid will be completed.

Fig. 22.

Cor. If in a geometrical plane two concentric circles be described, a truncated cone may be put in perspective in the same manner as a truncated pyramid.

Prob. 20. *To put in perspective a hollow prism lying on one of its sides.*

Fig. 23. Let ABDEC (fig. 23.) be a section of such a prism. Draw HI parallel to AB, and distant from it the breadth of the side on which the prism rests; and from each angle internal and external of the prism let fall perpendiculars to HI. The parallelogram will be thus divided by the ichnographical process below the ground-line, so as that the side AB of the real prism will be parallel to the corresponding side of the scenographic view of it.—To determine the altitude of the internal and external angles. From H (fig. 24.) raise HI perpendicular to the ground-line, and on it mark off the true altitudes H 1, H 2, H 3, H 4, and H 5. Then if from any point V in the horizon be drawn the straight lines VH, V 1, V 2, V 3, V 4, V 5 or VI; by a process similar to that of the preceding problem, will be determined the height of the internal angles, viz. 1=*a a*, 2=*b b*, 4=*d d*; and of the external angles, 3=*c c*, and 5=*e e*; and when these angles are formed and put in their proper places, the scenograph of the prism is complete.

Fig. 24

Prob. 21. *To put a square table in perspective, standing on four upright square legs of any given length with respect to the breadth of the table.*

In fig. 21. let ABCD be the square part of the floor on which the table is to stand, and EFGH the surface of the square table, parallel to the floor. Fig. 21.

Suppose the table to be three feet in breadth, and its height from the floor to be two feet; then two thirds of AD or EH will be the length of the legs *i* and *k*; the other two (*l* and *m*) being of the same length in perspective.

Having drawn the two equal and parallel squares ABCD and EFGH, as shown in Prob. 18. let the legs be square in form, and fixed into the table at a distance from its edges equal to their thickness. Take A *a* and D *d* equal to the intended thickness of the legs, and *a b* and *d c* also equal thereto. Draw the diagonals AC and BD, and draw straight lines from the points *a*, *b*, *c*, *d*, towards the point of sight S, and terminating at the side BC. Then, through the points where these lines cut the diagonals, draw the straight lines *n* and *o*, *p* and *q*, parallel to AD; and you will have formed four perspective squares (like ABCD in fig. 19.) for the bases of the four legs of the table: and then it is easy to draw the four upright legs by parallel lines, all perpendicular to AD; and to shade them as in the figure.

Fig. 19.

To represent the intended thickness of the table-board, draw *e h* parallel to EH, and HG toward the point of sight S: then shade the spaces between these lines, and the perspective figure of the table will be finished.

Prob. 22. *To put five square pyramids in perspective, standing upright on a square pavement composed of the surfaces of 81 cubes.*

In fig. 25. let ABCD be a perspective square drawn according to the foregoing rules; S the point of sight, P the point of distance in the horizon PS, and AC and BD the two diagonals of the square. Fig. 25.

Divide the side AD into 9 equal parts (because 9 times 9 is 81) as A *a*, *a b*, *b c*, &c. and from these points of division, *a*, *b*, *c*, *d*, &c. draw lines toward the point of sight S, terminating at the furthermost side BC of the square. Then, through the points where these lines cut the diagonals, draw straight lines parallel to AD, and the perspective square ABCD will be subdivided into 81 lesser squares, representing the upper surfaces of 81 cubes, laid close to one another's sides in a square form.

Draw AK and DL, each equal to A *a*, and perpendicular to AD; and draw LN toward the point of sight S: then draw KL parallel to AD, and its distance from AD will be equal to A *a*.—This done, draw *a l*, *c m*, *c n*, *d o*, *e p*, *f q*, *g r*, and *h s*, all parallel to AK; and the space ADLK will be subdivided into nine equal squares, which are the outer upright surfaces of the nine cubes in the side AD of the square ABCD.

From the points where the lines, which are parallel to AD in this square, meet the side CD thereof, draw short lines to LN, all parallel to DL, and they will divide that side into the outer upright surfaces of the nine cubes which compose it: and then the outsides of all the cubes that can be visible to an observer, placed at a proper distance from the corner D of the square, will be finished.

As taught in Prob. 17. place the pyramid AE upright on its square base A *t v a*, making it as high as you please; and the pyramid DH on its square base *k u w* D, of equal height with AE.

Draw EH from the top of one of these pyramids to the top of the other; and EH will be parallel to AD.

Draw ES and HS to the point of sight S, and HP to the point of distance P, intersecting ES in F.

From the point F, draw FG parallel to EH; then draw EG, and you will have a perspective square EFGH (parallel to ABCD) with its two diagonals EG and FH, intersecting one another in the centre of the square at I. The four corners of this square, E, F, G, H, give the perspective heights of the four pyramids AE, BF, CG, and DH; and the intersection I of the diagonals gives the height of the pyramid MI, the centre of whose base is the centre of the perspective square ABCD.

Lastly, place the three pyramids BF, CG, MI, upright on their respective bases at B, C, and M; and the required perspective representation will be finished as in the figure.

Prob. 23. *To put upright pyramids in perspective, on the sides of an oblong square or parallelogram; so that their distances from one another shall be equal to the breadth of the parallelogram.*

Fig. 26. In most of the foregoing operations we have considered the observer to be so placed, as to have an oblique view of the perspective objects: in this, we shall suppose him to have a direct view of fig. 26. that is, standing right against the middle of the end AD which is nearest to his eye, and viewing AD under an angle of 60 degrees.

Having cut AD in the middle, by the perpendicular line S*s*, take S therein at pleasure for the point of sight, and draw ES for the horizon, parallel to AD.—Here S*s* must be supposed to be produced downward, below the limits of the plate, to the place of the observer; and SE to be produced towards the left hand beyond E, far enough to take a proper point of distance therein, according to the foregoing rules.

Take A *d* at pleasure, and D *g* equal to A *d*, for the breadths of the square bases of the two pyramids AE and DF next the eye: then draw AS and *d* S, and likewise DS and *g* S, to the point of sight S; and DG on to the point of distance, intersecting AS in G: then, from G draw GI parallel to AD, you will have the first perspective square AGID of the parallelogram ABCD.

From I draw IH to (or toward) the point of distance, intersecting AS in H: then, from H draw HK parallel to AD, and you will have the second perspective square GHKI of the parallelogram.—Go on in this manner till you have drawn as many perspective squares up toward S as you please.

Through the point *e*, where DG intersect *g* S, draw *b f* parallel to AD; and you will have formed the two perspective square bases A *b c d* and *e f* D *g* of the two pyramids at A and D.

From the point *f* (the upper outward corner of *e f* D *g*) draw *f h* toward the point of distance, till it meets AS in *h*; then, from this point of meeting, draw *h m* parallel to GI, and you will have formed the two perspective squares G *h i k* and *l m* I *n*, for the square bases of the two pyramids at G and I.

Proceed in the same manner to find the bases of all the other pyramids, at the corners of the rest of the perspective squares in the parallelogram ABCD, as shown by the figure.—Then,

Having placed the first two pyramids at A and D upright on their square bases, as shown in Prob. 9. and made them of any equal heights at pleasure, draw ES and FS from the tops of these pyramids to the point of sight S: place all the rest of the pyramids upright on their respective bases, making their tops touch the straight lines ES and FS; and all the work, except the shading part, will be finished.

Prob. 24. *To put a square pyramid of equal sized cubes in perspective.*

Fig. 27. Fig. 27. represents a pyramid of this kind; consisting as it were of square tables of cubes, one table above another; 81 in the lowest, 49 in the next, 25 in the third, 9 in the fourth, and 1 in the fifth or uppermost. These are the square numbers of 9, 7, 5, 3, and 1.

If the artist is already master of all the preceding operations, he will find less difficulty in this than in attending to the following description of it: for it cannot be described in a few words, but may be executed in a very short time.

Fig. 28. In fig. 28. having drawn PS for the horizon, and taken S for the point of sight therein (the observer being at O) draw AD parallel to PS for the side (next the eye) of the first or lowermost table of cubes. Draw AS and DS to the point of sight S, and DP to the point of distance P, intersecting AS in the point B. Then, from B, draw BC parallel to AD, and you will have the surface ABCD of the first table.

Divide AD into nine equal parts, as A *a*, *a b*, *b c*, *c d*, &c. then make AK and DL equal to A *a*, and perpendicular to AD. Draw KL parallel to AD, and from the points of equal division at *a*, *b*, *c*, &c. draw lines to KL, all parallel to AK. Then draw *h* S to the point of sight S, and from the division points *a*, *b*, *c*, &c. draw lines with a black lead pencil, all tending towards the point of sight, till they meet the diagonal BD of the square.

From these points of meeting draw black lead lines to DC, all parallel to AD; then draw the parts of these lines with black ink which are marked 1, 2, 3, 4, &c. between *h* E and DC.

Having drawn the first of these lines *β q* with black ink, draw the parts *a i*, *b k*, *c l*, &c. (of the former lines which met the diagonal BD) with black ink also; and rub out the rest of the black lead lines, which would otherwise confuse the following part of the work. Then, draw LF towards the point of sight S; and, from the points where the lines 1, 2, 3, 4, &c. meet the line DC, draw lines down to LF, all parallel to DL; and all the visible lines between the cubes in the first table will be finished.

Make *i* G equal and perpendicular to *β i*, and *q* M equal and parallel to *i* G; then draw GM, which will be equal and parallel to *i q*. From the points *k*, *l*, *m*, *n*, &c. draw *k*, *n*, *l o*, *m p*, &c. all parallel to *i* G, and the outsides of the seven cubes in the side G *q* of the second table will be finished.

Draw GS and MS to the point of sight S, and MP to the point of distance P, intersecting GS in H; then, from the point of intersection H, draw HI parallel to AD; and you will have the surface GHIM of the second table of cubes.

From the points *n*, *o*, *p*, *q*, &c. draw black lead lines toward the point of sight S, till they meet the diagonal MH of the perspective square surface GHIM; and draw SM, with black ink, toward the point of sight.

From those points where the lines drawn from *n*, *o*, *p*, *q*, &c. meet the diagonal MH, draw black lead lines to MI, all parallel to AD; only draw the whole first line *γ* 1 with black ink, and the parts 2, 3, 4, &c. and *u t*, *o u*, *p v*, &c. of the other lines between *y* N and MI, and GM and *γ* 1, with the same; and rub out all the rest of the black lead lines, to avoid further confusion. Then, from the points where the short lines 1, 2, 3, &c. meet the line MI, draw lines down to *q* E, all parallel to M *q*, and the outer surfaces of the seven cubes in the side ME will be finished; and all these last lines will meet the former parallels 2, 3, 4, &c. in the line *q* E.

Make *t* O equal and perpendicular to *γ t*, and *y* P equal and parallel to *t* O; then draw OP, which will be equal and parallel to *t y*.—This done, draw OS and PS to the point of sight S, and PP to the point of distance P in the horizon. Lastly, from the point Q, where PP intersects OS, draw QR parallel to OP; and you will have the outlines OQRP of the surface of the third perspective table of cubes.

From the points *u*, *v*, *w*, *x*, draw upright lines to OP, all parallel to *t* O, and you will have the outer surfaces of the five cubes in the side O *y* of this third table.

From the points where these upright lines meet OP, draw lines toward the point of sight S, till they meet the diagonal PQ; and from these points of meeting draw lines to PR, all parallel to OP, making the parts 2, 3, 4, 5, of these lines with black ink which lie between ZY and PR. Then, from the points where these lines meet PR, draw lines down to *y* N; which will bound the outer surfaces of the five cubes in the side PN of the third table.

Draw the line δ 1 with black ink; and, at a fourth part of its length between δ and Z, draw an upright line to S, equal in length to that fourth part, and another equal and parallel thereto from Z to V: then draw SV parallel to δ Z, and draw the two upright and equidistant lines between δ Z and SV, and you will have the outer surfaces of the three cubes in the side SZ of the fourth table.

Draw SS and VS to the point of sight S in the horizon, and VP to the point of distance therein, intersecting SS in T; then draw TU parallel to SV, and you have STUV, the surface of the fourth table, which being reticulated or divided into 9 perspective small squares, and the uppermost cube W placed on the middlemost of the squares, all the outlines will be finished; and when the whole is properly shaded, as in fig. 27. the work will be done.

Prob. 25. *To represent a double cross in perspective.*

In fig. 29. let ABCD and EFGH be the two perspective squares, equal and parallel to one another, the uppermost directly above the lowermost, drawn by the rules already laid down, and as far asunder as is equal to the given height of the upright part of the cross; S being the point of sight, and P the point of distance, in the horizon PS taken parallel to AD. Fig. 29.

Draw AE, DH, and CG; then AEHD and DHGC shall be the two visible sides of the upright part of the cross; of which, the length AE is here made equal to three times the breadth EH.

Divide DH into three equal parts, HI, IK, and KD. Through these points of division, at I and K, draw MO and PR parallel to AD; and make the parts MN, IO, PQ, KR, each equal to HI: then draw MP and OR parallel to DH.

From M and O, draw MS and OS to the point of sight S; and from the point of distance P draw PN cutting MS in T: from T draw TU parallel to MO, and meeting OS in U; and you will have the uppermost surface MTUO of one of the cross pieces of the figure.——From R, draw RS to the point of sight S; and from U draw UV parallel to OR; and OUVR shall be the perspective square end next the eye of that cross part.

Draw PMX (as long as you please) from the point of distance P, through the corner M; lay a ruler to N and S, and draw XN from the line PX:—then lay the ruler to I and S, and draw YZS.—Draw XY parallel to MO, and make XW and YB equal and perpendicular to XY: then draw WB parallel to XY, and WXYB shall be the square visible end of the other cross part of the figure.

Draw BK toward the point of sight S; and from U draw UP to the point of distance P, intersecting YS in Z: then, from the intersection Z, draw Z *a* parallel to MO, and Z *b* parallel to HD, and the whole delineation will be finished.

This done, shade the whole, as in fig. 30. and you will have a true perspective representation of a double cross. Fig. 30.

Prob. 26. *To put three rows of upright square objects in perspective, equal in size, and at equal distances from each other, on an oblong square plane, the breadth of which shall be of any assigned proportion to the length thereof.*

Fig. 31. is a perspective representation of an oblong square plane, three times as long as it is broad, having a row of nine upright square objects on each side, and one of the same number in the middle; all equally high, and at equal distances from one another, both long-wise and cross-wise, on the same plane. Fig. 31.

In fig. 32. PS is the horizon, S the point of sight, P the Fig. 32.

the point of distance, and AD (parallel to PS) the breadth of the plane.

Draw AS, NS, and DS, to the point of sight S; the point N being in the middle of the line AD: and draw DP to the point of distance P, intersecting AS in the point B: then, from B draw BC parallel to AD, and you have the perspective square ABCD.

Through the point *i*, where DB intersects NS, draw *a e* parallel to AD; and you will have subdivided the perspective square ABCD into four lesser squares, as A *a i* N, N *i e* D, *a* B *k i*, and *i k* C *e*.

From the point C (at the top of the perspective square ABCD) draw CP to the point of distance P, intersecting AS in E; then from the point E draw EF parallel to AD; and you will have the second perspective square BEFC.

Through the point *l*, where CE intersects NS, draw *b f* parallel to AD; and you will have subdivided the square BEFC into the four squares B *b l k*, *k l f* C, *b* E *m l*, and *l m* F *f*.

From the point F (at the top of the perspective square BEFC) draw FP to the point of distance P, intersecting AS in I; then from the point I draw IK parallel to AD; and you will have the third perspective square EIKF.

Through the point *n*, where FI intersects NS, draw *c g* parallel to AD; and you will have subdivided the square EIKF into four lesser squares, E *c n m*, *m n g* F, *c* I *o n*, and *n o* K *g*.

From the point K (at the top of the third perspective square EIKF) draw KP to the point of distance P, intersecting AS in L; then from the point L draw LM parallel to AD; and you will have the fourth perspective square ILMK.

Through the point *p*, where KL intersects NS, draw *d h* parallel to AD; and you will have subdivided the square ILMK into the four lesser squares I *d p o*, *o p h* K, *d* L *q p*, and *p q* M *h*.

Thus we have formed an oblong square ALMD, whose perspective length is equal to four times its breadth, and it contains 16 equal perspective squares.—If greater length was still wanted, we might proceed further on toward S.

Take A 3, equal to the intended breadth of the side of the upright square object AQ (all the other sides being of the same breadth), and AO for the intended height. Draw O 18 parallel to AD, and make D 8 and 4 7 equal to A 3; then draw 3 S, 4 S, 7 S, and 8 S to the point of sight S; and among them we shall have the perspective square bases of all the 27 upright objects on the plane.

Through the point 9, where DB intersects 8 S, draw 1 10 parallel to AD, and you have the three perspective square bases A 1 2 3, 4 5 6 7, 8 9 10 D, of the three upright square objects at A, N, and D.

Through the point 21, where *e b* intersects 8 S, draw 14, 11 parallel to AD; and you will have the three perspective squares, *a* 14 15 16 17 18 19 20, and 21 11 *e* 22, for the bases of the second cross row of objects; namely, the next beyond the first three at A, N, and D.

Through the point *w*, where CE intersects 8 S, draw a line parallel to BC; and you will have three perspective squares, at B, *k*, and C, for the base of the third row of objects; one of which is set up at B.

Through the point *x*, where *f c* intersects 8 S, draw a line parallel to *b f*; and you will have three perspective squares, at *b*, *l*, and *x*, for the bases of the fourth cross row of objects.

Go on in this manner, as you see in the figure, to find the rest of the square bases, up to LM; and you will have 27 upon the whole oblong square plane, on which you are to place the like number of objects, as in fig. 31.

Having assumed AO for the perspective height of the three objects at A, N, and D (fig. 32.) next the observer's eye, and drawn O 18 parallel to AD, in order to make the objects at N and D of the same height as that at O; and having drawn the upright lines 4 15, 7 W, 8 X, and D 22, for the heights at N and D; draw OS and RS, 15 S and WS, XS and 22 S, all to the point of sight S: and these lines will determine the perspectively equal heights of all the rest of the upright objects, as shown by the two placed at *a* and B.

To draw the square tops of these objects, equal and parallel to their bases, we only need give one example, which will serve for all.

Draw 3 R and 2 Q parallel to AO, and up to the line RS; then draw PQ parallel to OR, and OPQR shall be the top of the object at A, equal and parallel to its square base A 1 2 3.—In the same easy way the tops of all the other objects are formed.

When all the rest of the objects are delineated, shade them properly, and the whole perspective scheme will have the appearance of fig. 31.

Prob. 27. *To put a square box in perspective, containing a given number of lesser square boxes of a depth equal to their width.*

Fig. 33. Let the given number of little square boxes or cells be 16, then 4 of them make the length of each side of the four outer sides *a b*, *b c*, *c d*, *d a*, as in fig. 33. and the depth *a f* is equal to the width *a e*. Whoever can draw the reticulated square, by the rules laid down towards the beginning of this article, will be at no loss about putting this perspective scheme in practice.

Prob. 28. *To put stairs with equal and parallel steps in perspective.*

Fig 34. In fig. 34. let *a b* be the given breadth of each step, and *a i* the height thereof. Make *b c*, *c d*, *d e*, &c. each equal to *a b*; and draw all the upright lines *a i*, *b l*, *c n*, *d p*, &c. perpendicular to *a h* (to which the horizon *s* S is parallel); and from the points *i*, *l*, *n*, *p*, *r*, &c. draw the equidistant lines *i* B, *l* C, *n* D, &c. parallel to *a h*; these distances being equal to that of *i* B from *a h*.

Draw *x i* touching all the corner-points *l*, *n*, *p*, *r*, *t*, *v*; and draw 2 16 parallel to *x i*, as far from it as you want the length of the steps to be.

Toward the point of sight S draw the lines *a* 1, *i* 2, *k* 3, *l* 4, &c. and draw 16 15, 14 13, 12 11, 10 9, 8 7, 6 5, 4 3, and 2 1, all parallel to A *h*, and meeting the lines *w* 15, *u* 13, *s* 11, &c. in the points 15, 13, 11, 9, 7, 5, 3, and 1: then from these points draw 15 14, 13 12, 11 10, 9 8, 7 6, 5 4, and 3 2, all parallel to *h a*; and the outlines of the steps will be finished. From the point 16 draw 16 A parallel to *h a*, and A *x* 16 will be part of the flat at the top of the uppermost step.

Fig. 35. This done, shade the work as in fig. 35. and the whole will be finished.

Prob. 29. *To put stairs with flats and opening in perspective, standing on a horizontal pavement of squares.*

Fig. 36. In fig. 36. having made S the point of sight, and drawn a recticulated pavement AB with black lead lines, which may be rubbed out again; at any distance from the side AB of the pavement which is nearest to the eye, and at any point where you choose to begin the stair at that distance, as *a*, draw G*a* parallel to BA, and take *a b* at pleasure for the height of each step.

Take *a b* in your compasses, and set that extent as many times upward from F to E as is equal to the first required number of steps O, N, M, L, K; and from these points of division in EF draw 1 *b*, 2 *d*, 3 *f*, 4 *h*, and E *k*, all equidistant from one another, and parallel to F *a*: then draw the equidistant upright lines *u b*, *t d*, *u f*, *v h*, *w k*, and I *m*, all perpendicular to F *a*: then draw *m b*, touching the outer corners of these steps at *m*, *k*, *h*, *f*, *d*, and *b*; and draw *n s* parallel to *m b*, as far from it as you want the length of the steps K, L, M, N, O to be.

Towards the point of sight S draw *m n*, *l* 5, *k o*, *i* 6, *h p*, *f q*, *d r*, and *b s*. Then parallel to the bottom-line BA) through the points *n*, *o*, *p*, *q*, *r*, *s*, draw *n* 8; 5, 14; 6, 15; 7, 16; 1, 17; and 2 *s*: which done, draw *n* 5 and *o* 6 parallel to *l m*, and the outlines of the steps K, L, M, N, O will be finished.

At equal distances with that between the lines marked 8 and 14, draw the parallel lines above marked 9 10 11 12 and 13; and draw perpendicular lines upwards from the points *n*, *o*, *p*, *q*, *r*, *s*, as in the figure.

Make H *m* equal to the intended breadth of the flat above the square opening at the left hand, and draw HW toward the point of sight S, equal to the intended length of the flat: then draw WP parallel to H *m*, and the outlines of the flat will be finished.

Take the width of the opening at pleasure, as from F to C, and draw CD equal and parallel to FE. Draw GH parallel to CD, and the short lines marked 33, 34, &c. just even with the parallel lines 1, 2, &c. From the points where these short lines meet CD draw lines toward the point of sight S till they meet DE; then from the points where the lines 38, 39, 40, &c. of the pavement meet C *y*, draw upright lines parallel to CD; and the lines which form the opening will be finished.

The steps P, Q, R, S, T, and the flat U above the arch V, are done in the same manner with those in fig. 34. as taught in Prob. 28. and the equidistant parallel lines marked 18, 19, &c. are directly even with those on the left-hand side of the arch V, and the upright lines on the right-hand side are equidistant with those on the left.

From the points where the lines 18, 19, 20, &c. meet the right-hand side of the arch, draw lines toward the point of sight S; and from the points where the pavement lines 29, 30, 31, 32, meet the line drawn from A towards the point of sight, draw upright lines toward the top of the arch.

Fig. 37. Having done the top of the arch, as in the figure, and the few steps to the right hand thereof, shade the whole as in fig. 37. and the work will be finished.

Prob. 30. *To put upright conical objects in perspective, as if standing on the sides of an oblong square, at distances from one another equal to the breadth of the oblong.*

Fig. 38. In fig. 38. the bases of the upright cones are perspective circles inscribed in squares of the same diameter; and the cones are set upright on their bases by the same rules as are given for pyramids, which we need not repeat here.

In most of the foregoing operations we have considered the observer's eye to be above the level of the tops of all the objects, as if he viewed them when standing on high ground. In this figure, and in fig. 41. and fig. 42. we shall suppose him to be standing on low ground, and the tops of the objects to be above the level of his eye.

Fig. 38. In fig. 38. let AD be the perspective breadth of the oblong square ABCD; and let A *a* and D *d* (equal to A *a*) be taken for the diameters of the circular bases of the two cones next the eye, whose intended equal heights shall be AE and DF.

Having made S the point of sight in the horizon parallel to AD, and found the proper point of distance therein, draw AS and *a* S to contain the bases of the cones on the left-hand side, and DS and *d* S for those on the right.

Having made the two first cones at A and D of equal height at pleasure, draw ES and FS from their tops to the point of sight, for limiting the perspective heights of all the rest of the cones. Then divide the parallelogram ABCD into as many equal perspective squares as you please; find the bases of the cones at the corners of these squares, and make the cones thereon, as in the figure.

If you would represent a ceiling equal and parallel to ABCD, supported on the tops of these cones, draw EF, then EFGH shall be the ceiling; and by drawing *e f* parallel to EF, you will have the thickness of the floor-boards and beams, which may be what you please.

This shows how any number of equidistant pillars may be drawn of equal heights to support the ceiling of a long room, and how the walls of such a room may be represented in perspective at the backs of these pillars. It also shows how a street of houses may be drawn in perspective.

Prob. 31. *To put a square hollow in perspective, the depth of which shall bear any assigned proportion to its width.*

Fig. 41. Fig. 41. is the repesentation of a square hollow, of which the depth AG is equal to three times its width AD; and S is the point of sight over which the observer's eye is supposed to be placed, looking perpendicularly down into it, but not directly over the middle.

Draw AS and DS to the point of sight S; make ST the horizon parallel to AD, and produce it to such a length beyond T that you may find a point of distance therein not nearer S than if AD was seen under an angle of 60 degrees.

Draw DU to the point of distance, intersecting AS in B; then from the point B draw BC parallel to AD;

and you will have the first perspective square ABCD, equal to a third part of the intended depth.

Draw CV to the point of distance, intersecting AS in E; then from the point E draw EF parallel to AD; and you will have the second perspective square BEFC, which, added to the former one, makes two thirds of the intended depth.

Draw FW to the point of distance, intersecting AS in G; then from the point G draw GH parallel to AD; and you will have the third perspective square EGHF, which, with the former two, makes the whole depth AGHD three times as great as the width AD, in a perspective view.

Divide AD into any number of equal parts, as suppose 8; and from the division-points *a*, *b*, *c*, *d*, &c. draw lines toward the point of sight S, and ending at GH; then through the points where the diagonals BD, EC, GF, cut these lines, draw lines parallel to AD; and you will have the parallelogram AGHD reticulated, or divided into 192 small and equal perspective squares.

Make AI and DM equal and perpendicular to AD; then draw IM, which will be equal and parallel to AD; and draw IS and MS to the point of sight S.

Divide AI, IM, and MD, into the same number of equal parts as AD is divided; and from these points of division draw lines toward the point of sight S, ending respectively at GK, KL, and LH.

From those points where the lines parallel to AD meet AG and DH draw upright lines parallel to AI and DM; and from the points where these lines meet IK and LM draw lines parallel to IM; then shade the work, as in the figure.

PROB. 32. *To represent a semicircular arch in perspective as if it were standing on two upright walls, equal in height to the height of the observer's eye.*

Fig. 42. After having gone through the preceding operation, this will be more easy by a bare view of fig. 42. than it could be made by any description; the method being so much like that of drawing and shading the square hollow.—We need only mention, that *a* T *b* EA and DF *c t d* are the upright walls on which the semicircular arch is built; that S is the point of sight in the horizon T *t*, taken in the centre of the arch; and *d* in fig. 41. is the point of distance; and that the two perspective squares ABCD and BEFC make the parallelogram AEFD of a length equal to twice its breadth AD.

PROB. 33. *To represent a square in perspective, as viewed by an observer standing directly even with one of its corners.*

Fig. 43. In fig. 43. let A 9 BC be a true square, viewed by an observer standing at some distance from the corner C, and just even with the diagonal C 9.

Let *p* SP be the horizon, parallel to the diagonal AB; and S the point of sight, even with the diagonal C 9. Here it will be proper to have two points of distance *p* and P, equidistant from the point of sight S.

Draw the straight line 1 17 parallel to AB, and draw A 8 and B 10 parallel to CS. Take the distance between 8 and 9 in your compasses, and set it off all the way in equal parts from 8 to 1, and from 10 to 17.—The line 1 17 should be produced a good way further both to right and left hand from 9, and divided all the way in the same manner.

From these points of equal division, 8, 9, 10, &c. draw lines to the point of sight S, and also to the two points of distance *p* and P, as in the figure.

Now it is plain, that *a c b* 9 is the perspective representation of A 9 BC, viewed by an observer even with the corner C and diagonal C 9.—But if there are other such squares lying even with this, and having the same position with respect to the line 1 17, it is evident that the observer, who stands directly even with the corner C of the first square, will not be even with the like corners G and K of the others; but will have an oblique view of them, over the sides FG and IK, which are nearest his eye: and their perspective representations will be *e g f* 6 and *h k i* 3, drawn among the lines in the figure: of which the spaces taken up by each side lie between three of the lines drawn toward the point of distance *p*, and three drawn to the other point of distance P.

PROB. 34. *To represent a common chair, in an oblique perspective view.*

The original lines to the point of sight S, and points of distance *p* and P, being drawn as in the preceding operation, choose any part of the plane, as *l m n* 13, on which you would have the chair L to stand.—There are just as many lines (namely two) between *l* and *m* or 13 and *n*, drawn toward the point of distance *p*, at the left hand, as between *l* and 13, or *m* and *n*, drawn to the point of distance P on the right: so that *l m*, *m n*, *n* 13, and 13 *l*, form a perspective square. Fig. 43.

From the four corners *l*, *m*, *n*, 13, of this square raise the four legs of the chair to the perspective perpendicular height you would have them: then make the seat of the chair a square equal and parallel to *l m n* 13, as taught in Prob. 18. which will make the two sides of the seat in the direction of the lines drawn toward the point of distance *p*, and the fore and back part of the seat in direction of the lines drawn to the other point of distance P. This done, draw the back of the chair leaning a little backward, and the cross bars therein tending toward the point of distance P. Then shade the work as in the figure; and the perspective chair will be finished.

PROB. 35. *To present an oblong square table in an oblique perspective view.*

In fig. 43. M is an oblong square table, as seen by an observer standing directly even with C 9 (see Prob. 33.), the side next the eye being perspectively parallel to the side *a c* of the square *a b c* 9.—The forementioned lines drawn from the line 1 17 to the two points of distance *p* and P, form equal perspective squares on the ground plane. Fig. 43.

Choose any part of this plane of squares for the feet of the table to stand upon; as at *p*, *q*, *r*, and *s*, in direction of the lines *o p* and *r s* for the two long sides, and *t s* and *q r* for the two ends; and you will have the oblong square or parallelogram *q r s t* for the part of the floor or ground-plane whereon the table is to stand: and the breadth of this plane is here taken in proportion to the length as 6 to 10; so that, if the length of the table be ten feet, its breadth will be six.

On the four little perspective squares at *q*, *r*, *s*, and *t*, *t*, place the four upright legs of the table, of what height you please, so that the height of the two next the eye, at *o* and *p*, shall be terminated by a straight line *u v* drawn to the point of distance P. This done, make the leaf M of the table an oblong square, perspectively equal and parallel to the oblong square *q r s t* on which the feet of the table stand. Then shade the whole, as in the figure, and the work will be finished.

If the line 1 17 were prolonged to the right and left hand, and equally divided throughout (as it is from 1 to 17), and if the lines which are drawn from *p* and P to the right and left hand sides of the plate were prolonged till they came to the extended line 1 17, they would meet it in the equal points of division. In forming large plans of this sort, the ends of slips of paper may be pasted to the right and left edges of the sheet on which the plan is to be formed.

Of the Anamorphosis, or reformation of distorted images.

By this means pictures that are so mishapen, as to exhibit no regular appearance of any thing to the naked eye, shall, when viewed by reflection, present a regular and beautiful image. The inventor of this ingenious device is not known. Simon Stevinus, who was the first that wrote upon it, does not inform us from whom he learned it. The principles of it are laid down by S. Vauzelard in his *Perspective Conique et Cylindrique;* and Gaspar Schott professes to copy Marius Bettinus in his description of this piece of artificial magic.

It will be sufficient for our purpose to copy one of the simplest figures of this writer, as by this means the mystery of this art will be sufficiently unfolded. Upon Fig. 44. the cylinder of paper, or pasteboard, ABCD, fig. 44. draw whatever is intended to be exhibited, as the letters IHS. Then with a needle make perforations along the whole outline; and placing a candle, G, behind this cylinder, mark upon the ground plane the shadow of them, which will be distorted more or less, according to the position of the candle or the plane, &c. This being done, let the picture be an exact copy of this distorted image, let a metallic speculum be substituted in the place of the cylinder, and let the eye of the spectator have the same position before the cylinder that the candle had behind it. Then looking upon the speculum, he will see the distorted image restored to its proper shape. The reformation of the image, he says, will not easily be made exact in this method, but it will be sufficiently so to answer the purpose.

Other methods, more exact and geometrical than this, were found out afterwards: so that these pictures could be drawn by certain rules, without the use of a candle. Schott quotes one of these methods from Bettinus, another from Herigonius, and another from Kircher, which may be seen in his *Magia*, vol. i. p. 162, &c. He also gives an account of the methods of reforming pictures by speculums of conical and other figures.

Instead of copying any of these methods from Schott or Bettinus, we shall present our readers with that which Dr Smith hath given us in his Optics, vol. 1. p. 250, as no doubt, the best, and from which any person may easily make a drawing of this kind. The same description answers to two mirrors, one of which, fig. 39. is Fig. 39. and 40. convex, and the other, fig. 40. is concave.

In order to paint upon a plane a deformed copy ABCDEKIHGF of an original picture, which shall appear regular, when seen from a given point O, elevated above the plane, by rays reflected from a polished cylinder, placed upon the circle *l n p*, equal to its given base; from the point R, which must be supposed to lie perpendicularly under O, the place of the eye, draw two lines R *a*, R *e;* which shall either touch the base of the cylinder, or else cut off two small equal segments from the sides of it, according as the copy is intended to be more or less deformed. Then, taking the eye, raised above R, to the given height RO, somewhat greater than that of the cylinder, for a luminous point, describe the shadow *a c k f* (of a square, fig. 39. or parallelogram standing upright upon *a e* Fig. 39. as a base, and containing the picture required) anywhere behind the arch *l n p*. Let the lines drawn from R to the extremities and divisions of the base *a*, *b*, *c*, *d*, *e*, cut the remotest part of the shadow in the points *f*, *g*, *h*, *i*, *k*, and the arch of the base in *l*, *m*, *n*, *o*, *p;* from which points draw the lines *l* AF, *m* BG, *n* CH, *o* DI, *p* EK, as if they were rays of light that came from the focus R, and were reflected from the base *l n p;* so that each couple, *l* A, *l* R, produced, may cut off equal segments from the circle. Lastly, Transfer the lines *l a f*, *m b g*, &c. and all their parts in the same order, upon the respective lines *l* AF, *m* BG, &c. and having drawn regular curves, by estimation, through the points A, B, C, D, E, through F, G, H, I, K, and through every intermediate order of points; the figure ACEKHF, so divided, will be the deformed copy of the square, drawn and divided upon the original picture, and will appear similar to it, when seen in the polished cylinder, placed upon the base *l n p*, by the eye in its given place O.

The practical methods of drawing these images seem to have been carried to the greatest perfection by J. Leopold, who, in the Acta Lipsiensia for the year 1712, has described two machines, one for the images to be viewed with a cylindrical, and the other with a conical mirror. The person possessed of this instrument has nothing to do but to take any print he pleases, and while he goes over the outlines of it with one pen, another traces the anamorphosis.

By methods of this kind, groves of trees may be cut, so as to represent the appearance of men, horses, and other objects from some one point of view, which are not at all discernible in any other. This might easily be effected by one person placing himself in any particular situation, and giving directions to other persons what trees to lop, and in what manner. In the same method it has been contrived, that buildings of circular and other forms, and also whole groups of buildings, consisting of walls at different distances and with different positions to one another, should be painted so as to exhibit the exact representation of particular objects, which could only be perceived in one situation. Bettinus has illustrated this method by drawings in his *Apiaria*.

It may appear a bold assertion to say, that the very short sketch now given of the art of perspective is a sufficient foundation for the whole practice, and includes *all* the expeditious rules peculiar to the problems which most generally occur. It is, however, true, and the intelligent reader will see, that the two theorems on which the whole rests, include every possible case, and apply with equal facility to pictures and originals in any position, although the examples are selected of perpendicular pictures, and of originals referred to horizontal planes, as being the most frequent. The scientific foundation being so simple, the structure need not be complex, nor swell into such volumes as have been published on the subject: volumes which by their size deter from the perusal, and give the simple art the appearance of intricate mystery; and by their prices, defeat the design of their authors, viz. the dissemination of knowledge among the practitioners. The treatises on perspective acquire their bulk by long and tedious discourses, minute explanations of common things, or by great numbers of examples; which indeed do make some of these books valuable by the variety of curious cuts, but do not at all instruct the reader by any improvements made in the art itself. For it is evident that most of those who have treated this subject have been more conversant in the practice of designing than in the principles of geometry; and therefore when, in their practice, the cases which have offered have put them on trying particular expedients, they have thought them worth communicating to the public as improvements in the art; and each author, fond of his own little expedient, (which a scientific person would have known for an easy corollary from the general theorem), has made it the principle of a practical system—in this manner narrowing instead of enlarging the knowledge of the art; and the practitioner tired of the bulk of the volume, in which a single maxim is tediously spread out, and the principle on which it is founded kept out of his sight, contents himself with a remembrance of the maxim (not understood), and keeps it slightly in his eye to avoid gross errors. We can appeal to the whole body of painters and draughtsmen for the truth of this assertion; and it must not be considered as an imputation on them of remissness or negligence, but as a necessary consequence of the ignorance of the authors from whom they have taken their information. This is a strong term, but it is not the less just. Several mathematicians of eminence have written on perspective, treating it as the subject of pure geometry, as it really is; and the performances of Dr Brook Taylor, Gravesande, Wolf, De la Caille, Emerson, are truly valuable, by presenting the art in all its perspicuous simplicity and universality. The works of Taylor and Emerson are more valuable, on account of the very ingenious and expeditious constructions which they have given, suited to every possible case. The merit of the first author has been universally acknowledged by all the British writers on the subject, who never fail to declare that their own works are composed on the principle of Dr Brook Taylor; but any man of science will see that these authors have either not understood them, or aimed at pleasing the public by fine cuts and uncommon cases; for without exception, they have omitted his favourite constructions, which had gained his predilection by their universality, and attached themselves to inferior methods, more usually expedient perhaps, or inventions (as they thought) of their own What has been given in this article is not *professed* to be according to the principles of Dr Brook Taylor, because the principles are not peculiar to him, but the necessary results of the theory itself, and inculcated by every *mathematician* who had taken the trouble to consider the subject. They are sufficient not only for directing the ordinary practice, but also for suggesting modes of construction for every case out of the common track. And a person of ingenuity will have a laudable enjoyment in this, without much stretch of thought, inventing rules for himself; and will be better pleased with such fruits of his own ingenuity, than in reading the tedious explanation of examples devised by another. And for this purpose we would, with Dr. Taylor, "advise all our readers not to be contented with the scheme they find here; but, on every occasion, to draw new ones of their own, in all the variety of circumstances they can think of. This will take up more time at first, but they will find the vast benefit and pleasure of it by the extensive notions it will give them of the nature of the principles."

The art of perspective is necessary to all arts where there is any occasion for designing; as architecture, fortification, carving, and generally all the mechanical arts; but it is more particularly necessary to the art of painting, which can do nothing without it. A figure in a picture, which is not drawn according to the rules of perspective, does not represent what is intended, but something else. Indeed we hesitate not to say, that a picture which is faulty in this particular, is as blameable, or more so, than any composition in writing which is faulty in point of orthography or grammar. It is generally thought very ridiculous to pretend to write a heroic poem, or a fine discourse, upon any subject, without understanding the propriety of the language in which we write; and to us it seems no less ridiculous for one to pretend to make a good picture without understanding perspective: Yet how many pictures are there to be seen, that are highly valuable in other respects, and yet are entirely faulty in this point? Indeed this fault is so very general, that we cannot remember that we ever have seen a picture that has been entirely without it; and what is the more to be lamented, the greatest masters have been the most guilty of it. Those examples make it to be the less regarded; but the fault is not the less, but the more to be lamented, and deserves the more care in avoiding it for the future. The great occasion of this fault, is certainly the wrong method that is generally used in educating of persons in this art: for the young people are generally put immediately to drawing; and when they have acquired a facility in that, they are put to colouring. And these things they learn by rote, and by practice only; but are not at all instructed in any rules of art. By which means, when they come to make any designs of their own, though they are very expert at drawing out and colouring every thing that offers itself to their fancy; yet for want of being instructed in the strict rules of art, they do not know how to govern their inventions with judgment, and become guilty of so many gross mistakes; which prevent themselves, as well as others, from finding that satisfaction they otherwise would do in their performances. To correct this for the future, we would recommend it to the masters of the art of painting, to consider if it would not be necessary to establish a better method for the education of their scholars, and to begin their instructions with the technical parts of painting, before they let them loose to follow the inventions of their own uncultivated imaginations.

The art of painting, taken in its full extent, consists of two parts; the inventive, and the executive. The inventive part is common with poetry, and belongs more properly and immediately to the original design (which it invents and disposes in the most proper and agreeable manner) than to the picture, which is only a copy of that design already formed in the imagination of the artist. The perfection of this art of painting depends upon the thorough knowledge the artist has of all the parts of his subject; and the beauty of it consists in the happy choice and disposition that he makes of it: And it is in this that the genius of the artist discovers and shows itself, while he indulges and humours his fancy, which here is not confined. But the other, the executive part of painting, is wholly confined and strictly tied to the rules of art, which cannot be dispensed with upon any account; and therefore in this the artist ought to govern himself entirely by the rules of art, and not to take any liberties whatsoever. For any thing that is not truly drawn according to the rules of perspective, or not truly coloured or truly shaded, does not appear to be what the artist intended, but something else. Wherefore, if at any time the artist happens to imagine that his picture would look the better, if he should swerve a little from these rules, he may assure himself, that the fault belongs to his original design, and not to the strictness of the rules; for what is perfectly agreeable and just in the real original objects themselves, can never appear defective in a picture where those objects are exactly copied.

Therefore to offer a short hint of thoughts we have some time had upon the method which ought to be followed in instructing a scholar in the executive part of painting: we would first have him learn the most common affections of practical geometry, and the first elements of plain geometry and common arithmetic. When he is sufficiently perfect in these, we would have him learn perspective. And when he has made some progress in this, so as to have prepared his judgment with the right notions of the alterations that figures must undergo, when they come to be drawn on a flat, he may then be put to drawing by view, and be exercised in this alone with perspective, till he comes to be sufficiently perfect in both. Nothing ought to be more familiar to a painter than perspective; for it is the only thing that can make the judgment correct, and will help the fancy to invent with ten times the ease that it could do without it.

We earnestly recommend to our readers the *careful* perusal of Dr Taylor's Treatise, as published by Colson in 1749, and Emerson's published along with his Optics. They will be surprised and delighted with the instruction they will receive; and will then truly estimate the splendid volumes of other authors, and see their frivolity.

Perspective.

PERSPECTIVE is also used for a kind of picture or painting, frequently seen in gardens, and at the ends of galleries; designed expressly to deceive the sight by representing the continuation of an alley, a building, landscape, or the like.

Aerial PERSPECTIVE, is sometimes used as a general denomination for that which more restrictedly is called *aerial perspective*, or the art of giving a due diminution or degradation to the strength of light, shade, and colours of objects, according to their different distances, the quantity of light which falls upon them, and the medium through which they are seen; the *chiaro obscuro*, or *clair obscure*, which consists in expressing the different degrees of light, shade, and colour of bodies, arising from their own shape, and the position of their parts with respect to the eye and neighbouring objects, whereby their light or colours are affected; and *keeping*, which is the observance of a due proportion in the general light and colouring of the whole picture, so that no light or colour in one part may be too bright or strong for another. A painter, who would succeed in *aerial perspective*, ought carefully to study the effects which distance, or different degrees or colours of light, have on each particular original colour, to know how its hue or strength is changed in the several circumstances that occur, and to represent it accordingly. As all objects in a picture take their measures in proportion to those placed in the front, so, in *aerial perspective*, the strength of light, and the brightness of the colours of objects close to the picture, must serve as a measure, with respect to which all the same colours at several distances must have a proportional degradation in like circumstances.

Bird's eye view in PERSPECTIVE, is that which supposes the eye to be placed above any building, &c. as in the air at a considerable distance from it. This is applied in drawing the representations of fortifications, when it is necessary not only to exhibit one view as seen from the ground, but so much of the several buildings as the eye can possibly take in at one time from any situation. In order to this, we must suppose the eye to be removed a considerable height above the ground, and to be placed as it were in the air, so as to look down into the building like a bird that is flying. In representations of this kind, the higher the horizontal line is placed, the more of the fortification will be seen, and *vice versa*.

PERSPECTIVE *Machine*, is an instrument by which any person, without the help of the rules of art, may delineate the true perspective figures of objects. Mr Ferguson has described a machine of this sort, of which he ascribes the invention to Dr Bevis.

Fig 45. and 46.

Fig. 45. is a plan of this machine, and fig. 46. is a representation of it when made use of in drawing distant objects in perspective.

In fig. 45. *a b e f* is an oblong square board, represented by ABEF in fig. 46. *x* and *y* (X and Y) are two hinges on which the part *c l d* (CLD) is moveable. This part consists of two arches or portions of circles *c m l* (CML) and *d n l* (DNL) joined together at the top *l* (L), and at bottom to the cross bar *d c* (DC), to which one part of each hinge is fixed, and the other part

PERSPECTIVE. PLATE CCCCX.

Fig. 1.

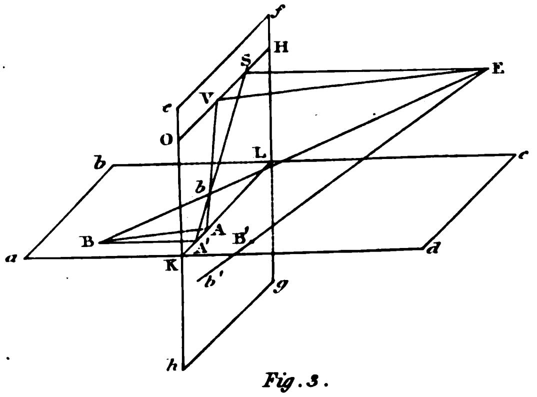


Fig. 2.

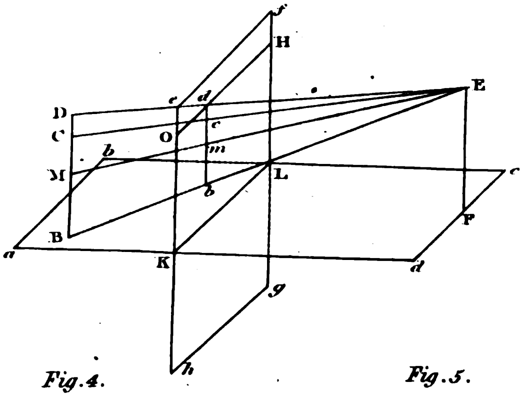


Fig. 3.

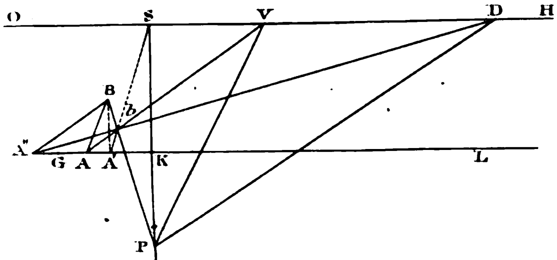


Fig. 4.

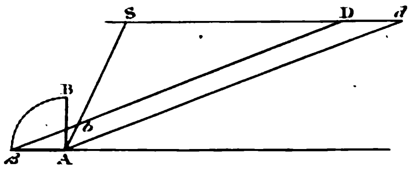
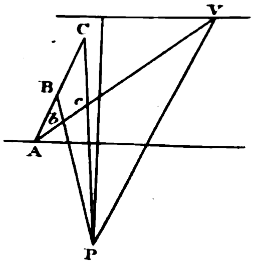


Fig. 5.



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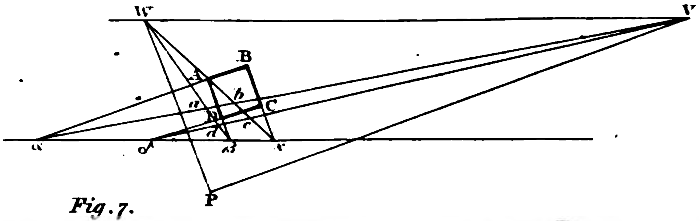
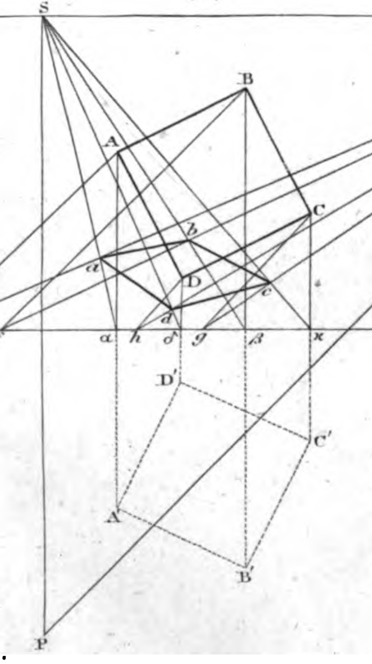


Fig. 7.



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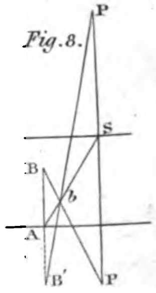


Fig. 9.

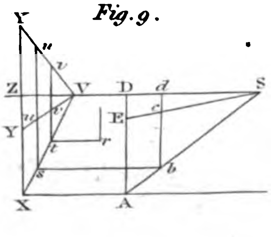


Fig. 10.

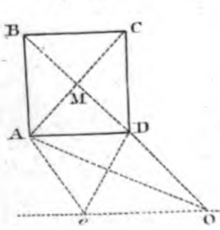
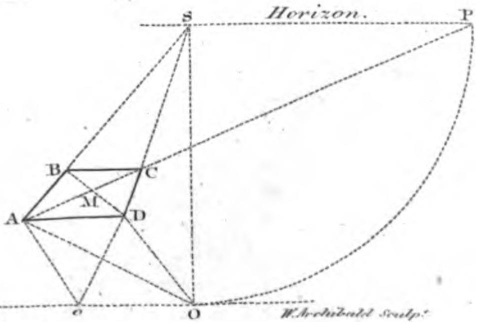


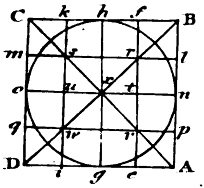
Fig. 11.



W. Archibald Sculp.

PERSPECTIVE. *PLATE CCCCXI.*

Fig. 12.



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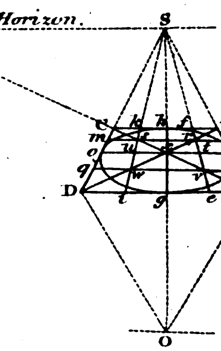


Fig. 14.

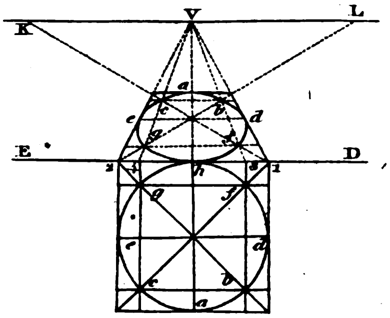


Fig. 15.

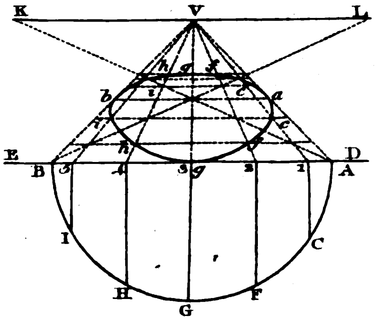
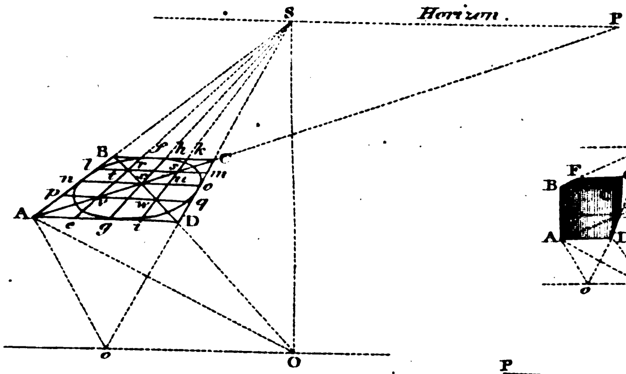


Fig. 16.



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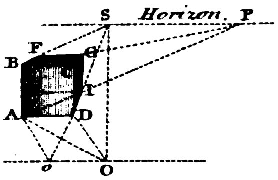

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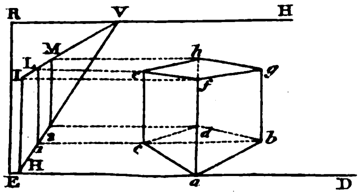

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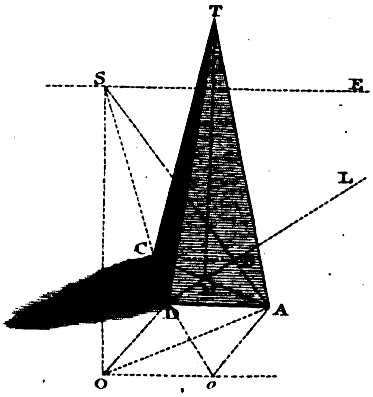

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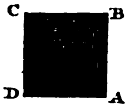

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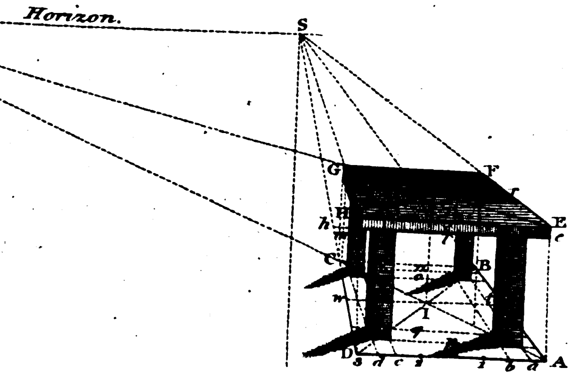

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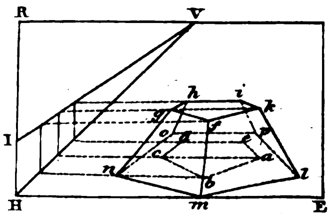

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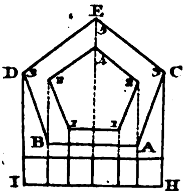

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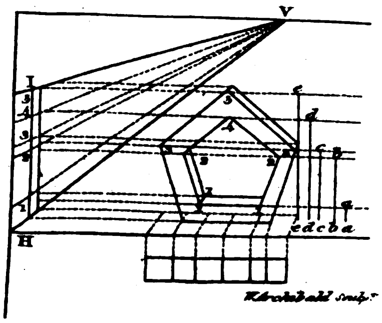
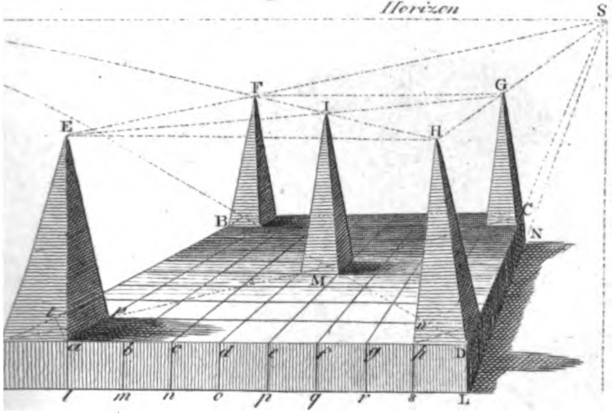


W. Archibald Sculp.

Fig. 25.



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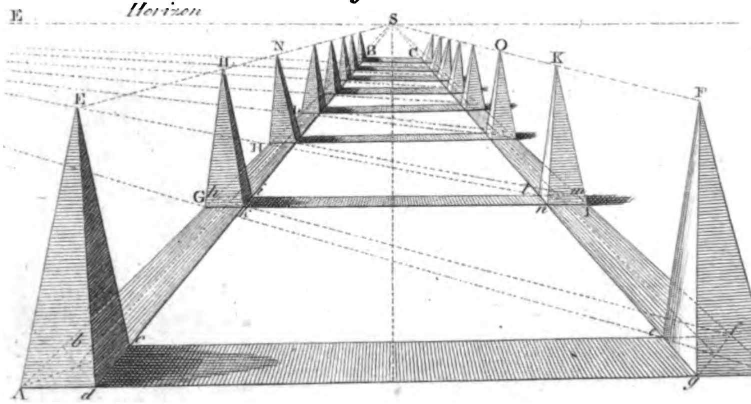

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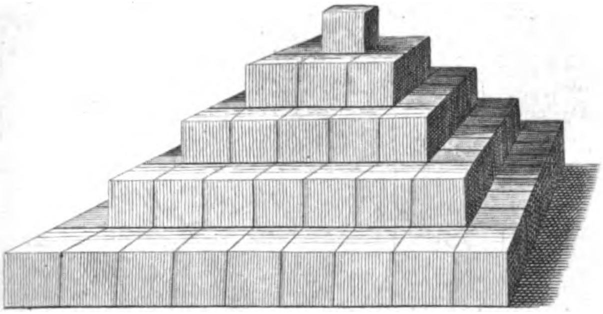

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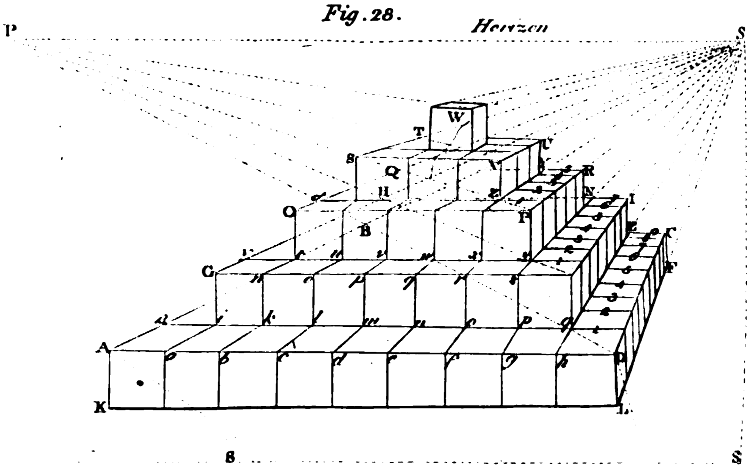

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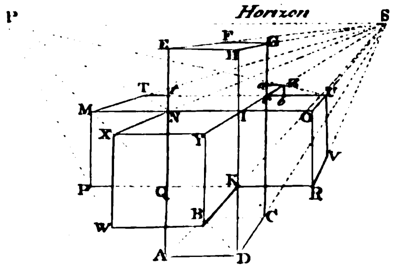

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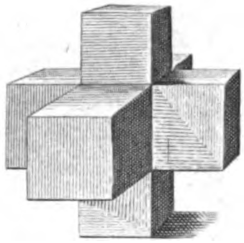

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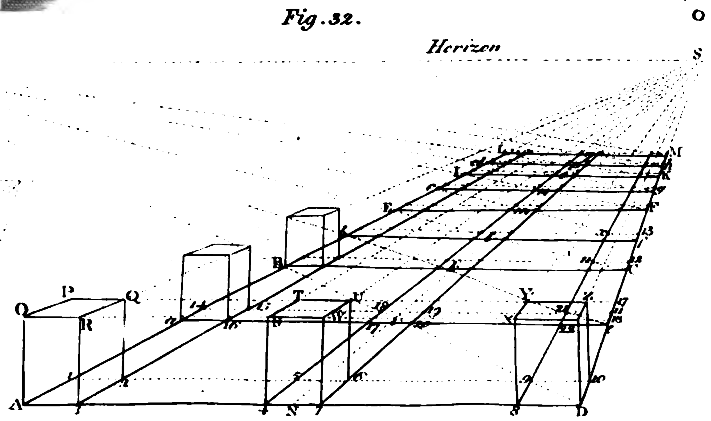

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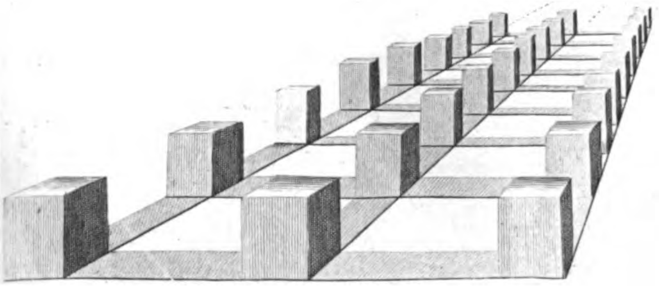
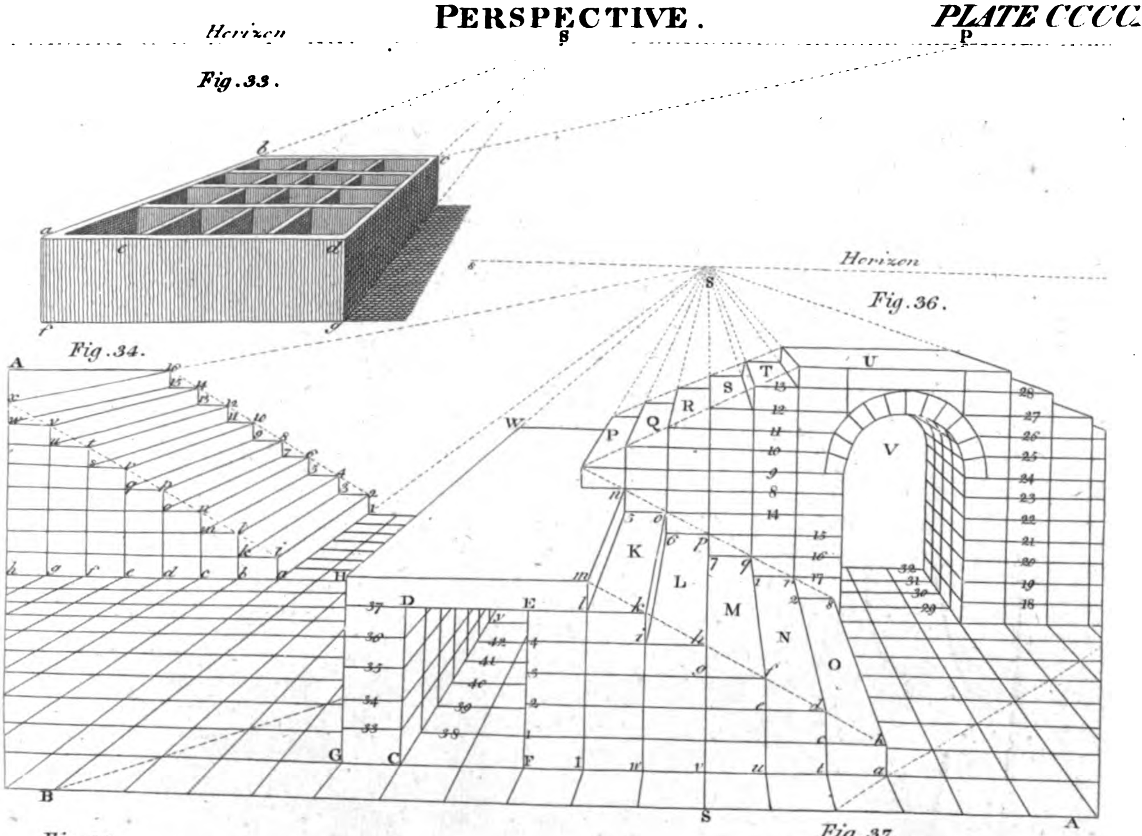


W. Archibald Sculp.



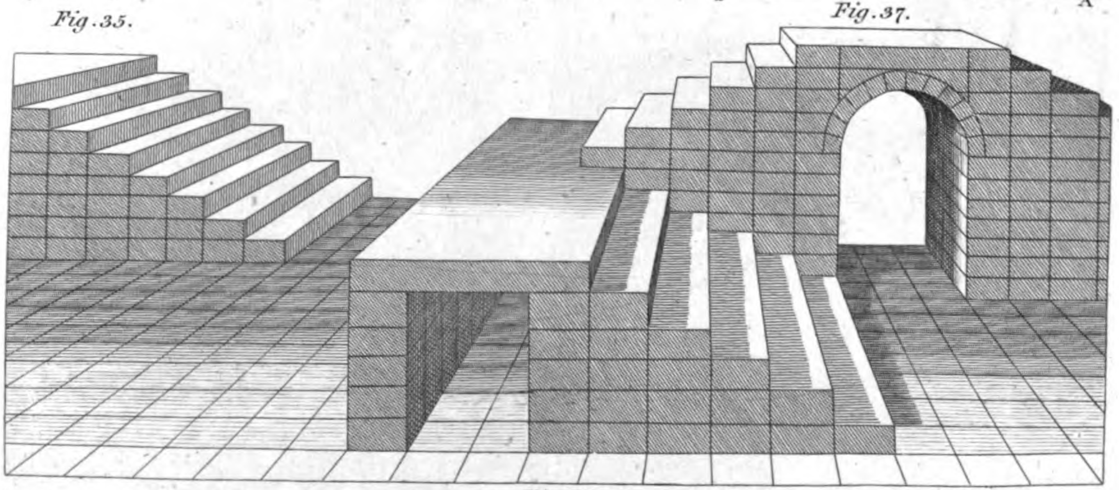
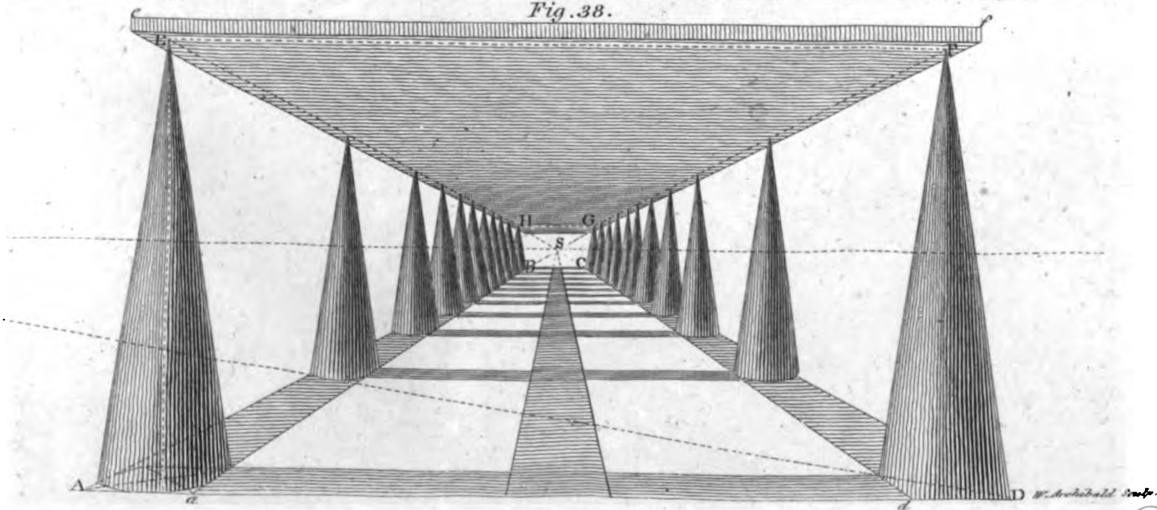
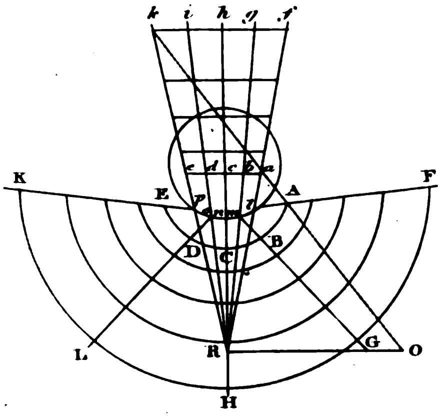


Fig. 35.
Fig. 37.



W. Archibald Sculp.

Fig. 39.



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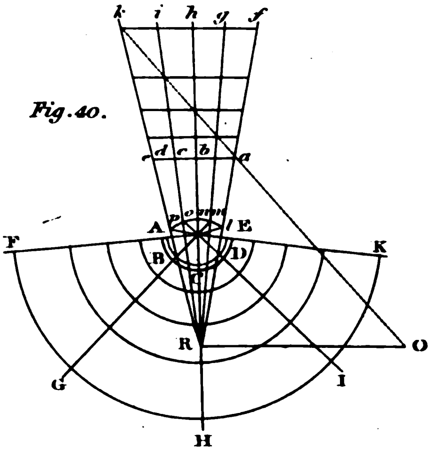

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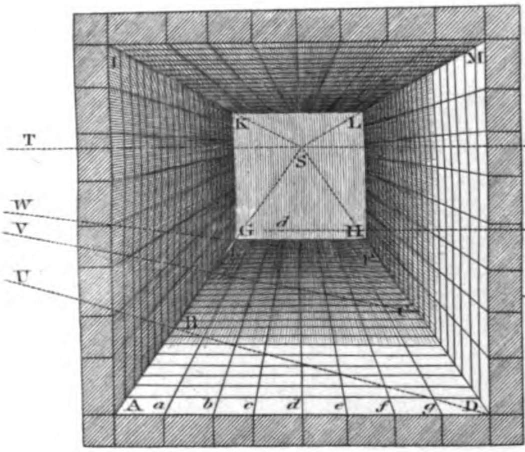

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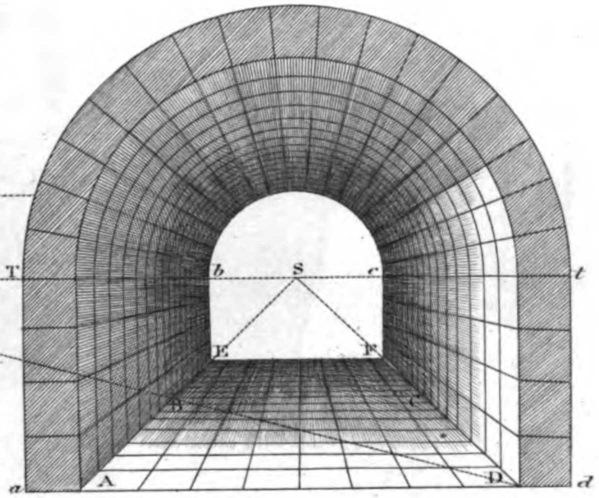

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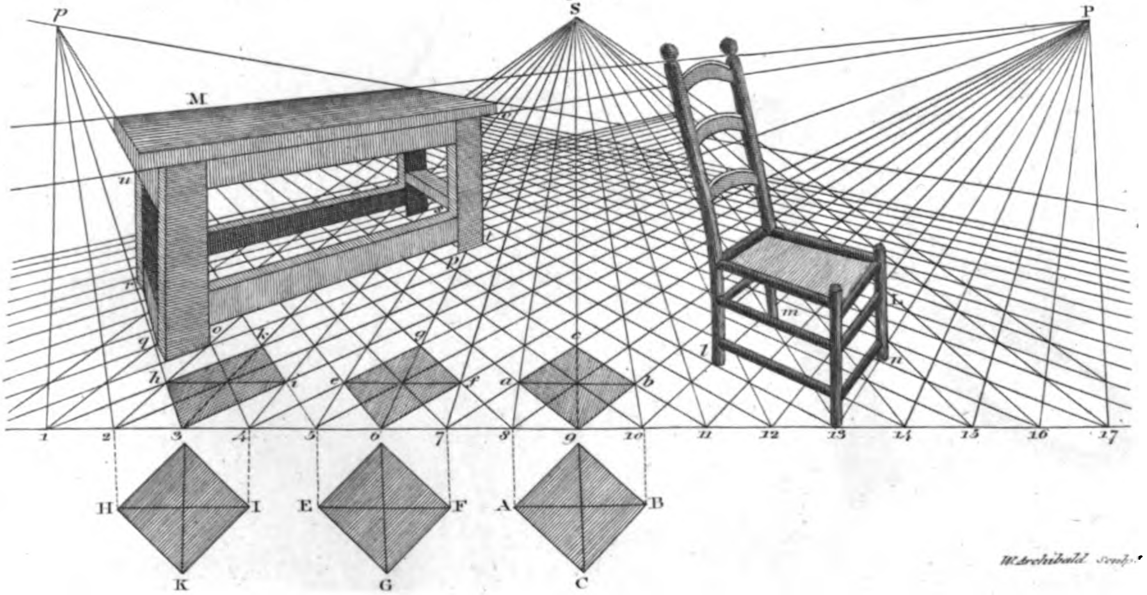
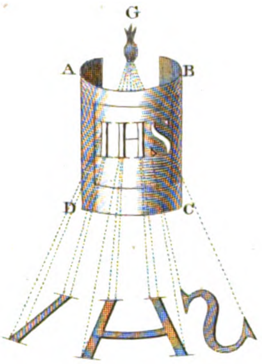


W. Archibald Sculp.

PERSPECTIVE. *PLATE CCCCXV.*

Fig. 44.



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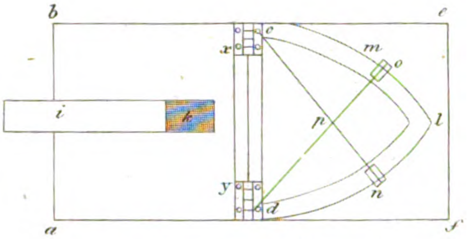

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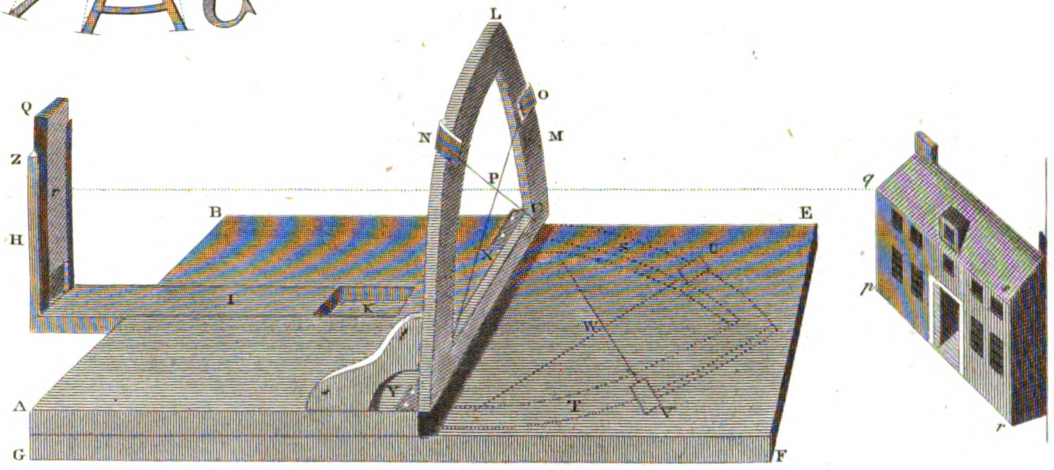

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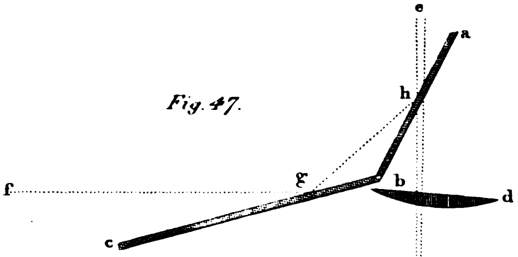


Fig. 48.

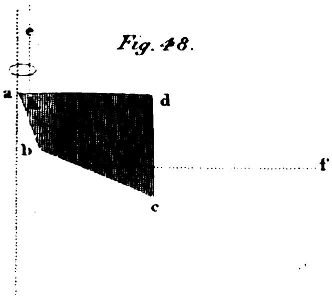
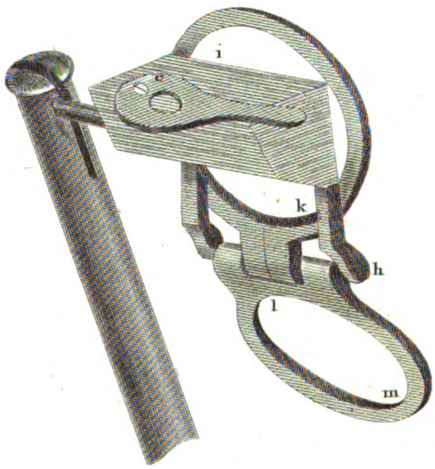


Fig. 49.



E. Mitchell sculp.t

part to a flat board, half the length of the board *a b e f* (ABEF), and glued to its uppermost side. The centre of the arch *c m l* is at *d*, and the centre of the arch *d n l* is at *c*.

On the outer side of the arch *d n l* is a sliding piece *n* (much like the nut of the quadrant of altitude belonging to a common globe), which may be moved to any part of the arch between *b* and *l*: and there is such another slider *o* on the arch *c m l*, which may be set to any part between *c* and *l*.—A thread *c p n* (CPN) is stretched tight from the centre c (C) to the slider *n* (N), and such another thread is stretched from the centre *d* (D) to the slider *o* (O); the ends of the thread being fastened to these centres and sliders.

Now it is plain, that, by moving these sliders on their respective arches, the intersection *p* (P) of the threads may be brought to any point of the open space within the arches.—In the groove *k* (K) is a straight sliding bar *i* (I), which may be drawn further out, or pushed further in at pleasure.

To the outer end of this bar I (fig. 46.) is fixed the upright piece HZ, in which is a groove for receiving the sliding piece Q. In this slider is a small hole *r* for the eye to look through, in using the machine; and there is a long slit in HZ, to let the hole *r* be seen through when the eye is placed behind it, at any height of the hole above the level of the bar I.

How to delineate the perspective figure of any distant object or objects, by means of this machine.

Suppose you wanted to delineate a perspective representation of the house *q s r p* (which we must imagine to be a great way off, without the limits of the plate), place the machine on a steady table, with the end EF of the horizontal board ABEF, toward the house, so that when the Gothic-like arch DLC is set upright, the middle part of the open space (about P) within it may be even with the house when you place your eye at Z and look at the house through the small hole *r*. Then fix the corners of a square piece of paper with four wafers on the surface of that half of the horizontal board which is nearest the house; and all is ready for drawing.

Set the arch upright, as in the figure; which it will be when it comes to the perpendicular side *t* of the upright piece *s t* fixed to the horizontal board behind D. Then place your eye at Z, and look through the hole *r* at any point of the house, as *q*, and move the sliders N and O till you bring the intersection of the threads at P directly between your eye and the point *q*: then put down the arch flat upon the paper on the board, as at ST, and the intersection of the threads will be at W. Mark the point W on the paper with the dot of a black lead pencil, and set the arch upright again as before: then look through the hole *r*, and move the sliders N and O till the intersection of the threads come between your eye and any other point of the house, as *p*: then put down the arch again to the paper, and make a pencil mark thereon at the intersection of the threads, and draw a line from that mark to the former one at W; which line will be a true perspective representation of the corner *p q* of the house.

Proceed in the same manner, by bringing the intersection of the threads successively between your eye and other points of the outlines of the house, as *r s*, &c. and put down the arch to mark the like points on the paper, at the intersection of the threads: then connect these points by straight lines, which will be the perspective outlines of the house. In like manner find points for the corners of the doors and windows, top of the house, chimneys, &c. and draw the finishing lines from point to point: then shade the whole, making the lights and shades as you see them on the house itself, and you will have a true perspective figure of it.—Great care must be taken, during the whole time, that the position of the machine be not shifted on the table; and to prevent such an inconvenience, the table should be very strong and steady, and the machine fixed to it either by screws or clamps.

In the same way, a landscape, or any number of objects within the field of view through the arch, may be delineated, by finding a sufficient number of perspective points on the paper, and connecting them by straight or curved lines as they appear to the eye. And as this makes every thing in perspective equally easy, without taking the trouble to learn any of the rules for drawing, the operations must be very pleasing and agreeable. Yet as science is still more so, we would by all means recommend it to our readers to learn the rules for drawing particular objects; and to draw landscapes by the eye, for which, we believe, no perspective rules can be given. And although any thing may be very truly drawn in perspective by means of this machine, it cannot be said that there is the least degree of science in going *that* way to work.

The arch ought to be at least a foot wide at bottom, that the eye at Z may have a large field of view through it: and the eye should then be, at least, $10\frac{1}{2}$ inches from the intersection of the threads at P when the arch is set upright. For if it be nearer, the boundaries of view at the sides near the foot of the arch will subtend an angle at Z of more than 60 degrees, which will not only strain the eye, but will also cause the outermost parts of the drawing to have a disagreeable appearance. —To avoid this, it will be proper to draw back the sliding bar I, till Z be $14\frac{1}{2}$ inches distant from P; and then the whole field of view, through the foot wide arch, will not subtend an angle to the eye at Z of more than 45 degrees; which will give a more easy and pleasant view, not only of all the objects themselves, but also of their representations on the paper whereon they are delineated. So that whatever the width of the arch be, the distance of the eye from it should be in this proportion: as 12 is to the width of the arch, so is $14\frac{1}{2}$ the distance of the eye (at Z) from it.

If a pane of glass, laid over with gum water, be fixed into the arch, and set upright when dry, a person who looks through the hole *r* may delineate the objects upon the glass which he sees at a distance through and beyond it, and then transfer the delineation to a paper put upon the glass, as mentioned in the beginning of the article PERSPECTIVE.

Mr Peacock likewise invented three simple instrument for drawing architecture and machinery in perspective, of which the reader will find sketches and descriptions in the 75th volume of the Philosophical Transactions. These descriptions are not inserted here, because we do not think the instruments superior to that described by Ferguson, and because we wish that our readers who have occasion to *draw* may make themselves so much masters of the art of perspective, as to be above the

the aid of such mechanical contrivances. But for the sake of those whose opportunities of improvement in the art do not enable them to practise it without such helps, we annex the following description of an instrument invented for this purpose by Dr Wollaston, and to which he has given the name of *Camera Lucida*.

" Having a short time since (says the author) amused myself with attempts to sketch various interesting views, without an adequate knowledge of the art of drawing, my mind was naturally employed in facilitating the means of transferring to paper the apparent relative positions of the objects before me; and I am in hopes that the instrument, which I contrived for this purpose, may be acceptable even to those who have attained to greater proficiency in the art, on account of the many advantages it possesses over the camera obscura.

" The principles on which it is constructed will probably be most distinctly explained by tracing the successive steps, by which I proceeded in its formation.

" While I look directly down at a sheet of paper on my table, if I hold between my eye and the paper a piece of plain glass, inclined from me downwards at an angle of 45°, I see by reflection the view that is before me, in the same direction that I see my paper through the glass. I might then take a sketch of it; but the position of the objects would be reversed.

" To obtain a direct view, it is necessary to have two reflections. The transparent glass must for this purpose be inclined to the perpendicular line of sight only the half of 45°, that it may reflect the view a second time from a piece of looking-glass placed beneath it, and inclined upwards at an equal angle. The objects now appear as if seen through the paper in the same place as before; but they are direct instead of being inverted, and they may be discerned in this manner sufficiently well for determining the principal positions.

" The pencil, however, and any object, which it is to trace, cannot both be seen distinctly in the same state of the eye, on account of the difference of their distances; and the efforts of successive adaption of the eye to one or to the other would become painful if frequently repeated. In order to remedy this inconvenience, the paper and pencil may be viewed through a convex lens of such a focus, as to require no more effort than is necessary for seeing the distant objects distinctly. These will then appear to correspond with the paper in *distance* as well as *direction*, and may be drawn with facility, and with any desired degree of precision.

" This arrangement of glasses will be best understood from inspecting fig. 47. *a b* in the transparent glass; *b c* the lower reflector; *b d* a convex lens (of 12 inches focus); *e* the position of the eye; and *f g h e* the course of the rays.

" In some cases a different construction will be preferable. Those eyes, which without assistance are adapted to seeing near objects alone, will not admit the use of a convex glass; but will on the contrary require one that is concave to be placed in front, to render the distant objects distinct. The frame for a glass of this construction is represented at *i k*, (fig. 49.) turning upon the same hinge at *h* with a convex glass in the frame *l m*, and moving in such a manner, that either of the glasses may be turned alone into its place, as may be necessary to suit an eye that is long or short sighted. Those persons, however, whose sight is nearly perfect, may at pleasure use either of the glasses.

" The instrument represented in that figure differs moreover in other respects from the foregoing, which I have chosen to describe first, because the action of the reflectors there employed would be more generally understood. But those who are conversant with the science of optics will perceive the advantage that may be derived in this instance from prismatic reflection; for when a ray of light has entered a solid piece of glass, and falls from within upon any surface, at an inclination of only twenty-two or twenty-three degrees, as above supposed, the refractive power of the glass is such as to suffer none of that light to pass out, and the surface becomes in this case the most brilliant reflector that can be employed.

" Fig. 58. represents the section of a solid prismatic piece of glass, within which both the reflections requisite are effected at the surfaces *a b*, *b c*, in such a manner that the ray *f g*, after being reflected first at *g*, and again at *h*, arrives at the eye in a direction *h e* at right angles to *f g*.

" There is another circumstance in this construction necessary to be attended to, and which remains to be explained. Where the reflection was produced by a piece of plain glass, it is obvious that any objects behind the glass (if sufficiently illuminated) might be seen through the glass as well as the reflected image. But when the prismatic reflector is employed, since no light can be transmitted directly through it, the eye must be so placed that only a part of its pupil may be intercepted by the edge of the prism, as at *e*, fig. 48. The distant objects will then be seen by this portion of the eye, while the paper and pencil are seen past the edge of the prism by the remainder of the pupil.

" In order to avoid inconvenience that might arise from unintentional motion of the eye, the relative quantities of light to be received from the object, and from the paper, are regulated by a small hole in a piece of brass, which by moving on a centre at *c*, fig. 49. is capable of adjustment to every inequality of light that is likely to occur.

" Since the size of the whole instrument, from being so near the eye, does not require to be large, I have on many accounts preferred the smallest size that could be executed with correctness, and have had it constructed on such a scale, that the lenses are only three-fourths of an inch in diameter.

" Though the original design, and principal use of this instrument is to facilitate the delineation of objects in true perspective, yet this is by no means the sole purpose to which it is adapted; for the same arrangement of reflectors may be employed with equal advantage for copying what has been already drawn, and may thus assist a learner in acquiring at least a correct outline of any subject.

" For this purpose the drawing to be copied should be placed as nearly as may be at the same distance before the instrument that the paper is beneath the eye-hole; for in that case the size will be the same, and no lens will be necessary either to the object, or to the pencil.

" By a proper use of the same instrument, every purpose of the pentagraph may also be answered; as a painting may be reduced in any proportion required, by placing it at a distance in due proportion greater than that of the paper from the instrument. In this case a lens becomes requisite for enabling the eye to see at two unequal distances with equal distinctness, and in order that one lens may suit for all these purposes, there is an advantage in carrying the height of the stand according to the proportion in which the reduction is to be effected.

"The principles on which the height of the stem is adjusted will be readily understood by those who are accustomed to optical considerations. For as in taking a perspective view the rays from the paper are rendered *parallel*, by placing a lens at the distance of its *principal* focus from the paper, because the rays received from the distant objects are *parallel;* so also when the object seen by reflection is at so short a distance that the rays received from it are in a certain degree *divergent*, the rays from the paper should be made to have the same degree of divergency in order that the paper may be seen distinctly by the same eye; and for this purpose the lens must be placed at a distance less than its principal focus. The stem of the instrument is accordingly marked at certain distances to which the conjugate foci are in the several proportions of 2, 3, 4, &c. to 1, so that distinct vision may be obtained in all cases, by placing the painting proportionally more distant.

"By transposing the convex lens to the front of the instrument and reversing the proportional distances, the artist might also enlarge his smaller sketches with every desirable degree of correctness, and the naturalist might delineate minute objects in any degree magnified."

PERSPECTIVE *Glass*, or *Graphical Perspective*. See DIOPTRICS.

PERSPIRATION, in *Physiology*, the excretion of a fluid through the pores of the skin. Perspiration is distinguished into sensible and insensible; and here sensible perspiration is the same with sweating, and insensible perspiration that which escapes the notice of the senses.

PERSPICUITY, properly signifies the property which any thing has of being easily seen through; hence it is generally applied to such writings or discourses as are easily understood.

PERSPICUITY, in composition. See ORATORY, N° 43.

PERTH, a county of Scotland, including Menteith, Braidalbin, Athol, Stratherne, part of Gowrie, and Perth Proper; is bounded by Badenoch and Lochaber on the north and north-west; by Marr on the north-east; by Argyle and Lennox on the west and south-west; having Clackmannanshire, part of Stirlingshire, and the Forth to the south; the shires of Kinross and Fife to the south-east, and Angus to the east. It extends above 70 miles in length, and near 60 at its greatest breadth, exhibiting a variety of Highlands and Lowlands; mountains, hills, dales, and straths, diversified with pasture grounds, corn fields, and meadows; rivers, lakes, forests, woods, plantations, inclosures, towns, villages, and a great number of elegant seats, beautifully situated, belonging to noblemen and gentlemen. The chief rivers of Perthshire are the Tay, the Teith, and the Erne, besides a great number of subordinate streams. The river Tay is famous for its salmon-fishery. The river Erne rises from Loch Erne, a lake seven miles long, in the mountainous country of Stratherne: this river, after a course of 34 miles from west to east, during which it receives many streams and rivulets, falls into the Tay at Abernethy.

Heron's Tour, 1792.

"The Tay (says a late traveller), on the southern bank of which the city of Perth stands, is truly a noble river. It rises in Braidalbin, on the frontiers of Lorne. Before it has advanced many miles from its source, its stream is considerably augmented by the accession of several small rills. Soon after, it diffuses its waters into a small lake called Loch Dochart; and indeed the river itself there bears rather the name of the Dochart. Continuing its course from Loch Dochart, it soon again expands into another lake. Out of this it proceeds to Killin, still bearing, if I remember right, the name of the Dochart. Here it meets with another river which flows hither by a more north-easterly course. The waters are diffused into the famous Loch Tay, 16 miles in length. Issuing from this spacious lake at Kenmore, the Tay is soon after increased by the accession of the Lyon. It proceeds onward in an eastern direction through Athol, receiving as it advances all the waters in the country, till at Logierait it is joined by the large river of Tummel. Here it bends to the south, and advancing about eight miles reaches Dunkeld; whence taking a more northern direction, it continues its course towards Perth; being as it advances still augmented by the accession of various tributary streams, the most considerable of which is the Almond. At Perth it turns to the south-east, and receiving as it proceeds the waters of the Erne, passes by Abernethy, once the capital of the Pictish kingdom. Soon after this, it expands itself to the breadth of three miles. Contracting its breadth, as it approaches Dundee, it there opens into the German ocean.

"Such is the noble river; on the southern bank of which, where it has increased into a vast body of water, and not a great many miles above where it discharges itself into the ocean, Perth is advantageously situated. A person acquainted with the general character of great rivers, and with their influence in determining the aspect and the fertility of the districts through which they pass, might readily, without farther knowledge of the local circumstances than what is conveyed in this account of the course of the Tay, and of the situation of Perth upon it, conclude the city to stand amid delightful scenery, and to enjoy most of the advantages which natural circumstances afford, for the promotion of trade and industry."

Freestone, lead, iron, and copper ores, with some lapis calaminaris, are found in different parts of Perthshire. The soil, being generally rich and well manured, produces excellent wheat, and all kinds of grain. The hilly country abounds with pasture for the black cattle, horses, sheep, goats, and deer. The heaths, woods, and forests, are stored with variety of game; the rivers teem with salmon and trout; the gardens and orchards are stored with all kinds of herbs, roots, apples, pears, cherries, plums, and almost every species of fruit found in South Britain. The houses and attire, even of the commonalty, are neat and decent; and every peasant can produce a good quantity of linen, and great store of blankets, made in his own family. Indeed, this is the case through all the Lowlands of Scotland. Flax is reared by every husbandman; and being dressed at home, is spun by the females of his family into thread for linen; this is woven by country weavers, of whom there is a great number through all the low country, and afterwards

wards bleached or whitened by the good-wife and her servants; so that the whole is made fit for use at a very small expence. They likewise wash, card, spin, and weave their wool into tartan for plaids, kersies, and coarse russet-cloth, for common wearing, besides great part of it which is knit into caps, stockings, and mitts. Plaids, made of the finest worsted, are worn either plain or variegated, as veils, by women of the lower, and even of the middle rank; nay some years ago, ladies of fashion wore silken plaids with an undress: this is a loose piece of drapery, gathered about the head, shoulders, and waist, on which it is crossed, so as to leave the hands at liberty, and produces a very good effect to the eye of the spectator. The Lowlanders of Perthshire are civilized, hospitable, and industrious: the commerce of the country consists chiefly in corn, linen, and black cattle: there are, moreover, some merchants who trade to foreign countries.—For an account of the different divisions of this country above mentioned, see the articles as they occur in the order of the alphabet.

The population of this county in 1801 amounted to 126,366 (A), and in 1811 to 135,093.

The following table shows the state of the population, according to its parishes at two different periods.

	Parishes.	Population in 1755.	Population in 1790—1798.
1	Aberdalgy	320	523
	Aberfoil	895	790
	Abernethy	1490	1415
	Abernyte	258	345
5	Alyth	2680	2723
	Arngask	736	554
	Auchterarder	1194	1670
	Auchtergaven	1677	1784
	Balquhidder	1592	1300
10	Blackford	1681	1360
	Blair Athol	3257	3120
	Blairgowrie	1596	1651
	Bendothy	1293	878
	Callander	1750	2100
15	Caputh	2048	2045
	Cargill	1897	1720
	Clunie	905	1037
	Collace	499	473
	Comrie	2546	3000
20	Crieff	1414	2640
	Culross	1695	1442
	Cupar	1491	2076
	Dron	598	450
	Dull	5748	4676
25	Dumbarnie	764	1250
	Dumblane	2728	2750
	Dunkeld	1298	1773
	Dunkeld, Little	2919	2705
	Dunning	1491	1600
30	Errol	2229	2685
	Forgandenny	1295	978
	Fortevoit	1164	970
	Fortingal	3859	3914
	Fossaway	1765	1505
35	Foulis, Wester	1706	1224
	Foulis, Easter	586	648
	Gask	385	486
	Glendovan	220	240
	Inchture	893	1000
40	Kenmure	3067	3463
	Killin	1968	2360
	Kilmadock	2730	3209
	Kilspindie	828	718
	Kincardine	1250	2068
45	Kinclaven	993	1150
	Kinfauns	639	628
	Kinloch	331	372
	Kinnaird	557	404
	Kinnoul	1163	1465
50	Kirkmichael	2689	2200
	Lecropt	577	420
	Lethendy	346	367
	Logie	1985	1500
	Logierait	2487	2200
55	Longforgan	1285	1526
	Maderty	796	631
	Meigle	1285	1148
	Methven	1790	1786
	Monedie	1492	1320
60	Monivaird	1460	1025
	Monzie	1192	1136
	Moulin	2109	1749
	Muckhart	535	526
	Muthil	2902	2948
65	Perth	9019	19,871
	Port	1865	1765
	Rattray	751	500
	Redgorton	1074	2123
	Rhind	498	495
70	St Madoes	189	300
	St Martins	1083	1090
	Scone	889	1442
	Tippermuir	988	1280
	Trinity Gask	913	795
75	Tulliallan	1321	2430
76	Weem	1295	1364
		118,903	133,274
			118,903
		Increase,	14,371

See PERTHSHIRE, SUPPLEMENT.

PERTH Proper, stretching 20 miles in length, and at some places 15 in breadth, is bounded on the north-east, by the Carse of Gowrie; on the east, by Angus; on the west, by Stratherne; on the north, by Athol; and on the south, by the frith of Tay. This is likewise a fruitful country, populous and well cultivated, abounding with gentlemen who possess opulent estates; with farmers who understand agriculture; and with manufacturers who turn their industry to great account. Northeastward from Perth to Brechin lies the vale of Strathmore, one of the most fertile districts in Scotland, which gives the title of *Earl* to the noble family of Lyon.

PERTH,

(A) It is supposed that there is some error in the statement of the population in 1801, by which it appears to be less than in 1790 and 1798. But by the return of the population of the town of Perth, the amount in 1801 is only 14,878; and in 1791 it was nearly 20,000, which will account for the difference.

Perth. **Perth**, the capital of the county of that name, is an agreeable, populous town, situated 20 miles within land, on the south bank of the river Tay. It was otherwise called *St Johnston's*, from a church dedicated to St John, as the patron of the place. It is a royal borough, second in dignity to the metropolis, the seat of a large presbytery, and gave the title of *Earl* to the family of Drummond, which is now forfeited. James Drummond, 4th earl, was created duke of Perth by James II. for adhering to whose interests he was outlawed. His two grandsons were attainted in 1745. No less than 14 national councils have been held at Perth between 1201 and 1459. But the oldest was at Scone, A. D. 906. Perth, in the reign of Edward I. of England, was possessed by the English, who secured it with fortifications: but after an obstinate resistance, they were expelled by Robert Bruce. In the year 1715, the rebels made it a place of arms, and retired to it, after the battle of Dumblane; but they were in a little time dislodged by the duke of Argyle, and retreated northwards with the pretender. They possessed it also in 1745. The pretender was proclaimed king, new magistrates were appointed, and an attempt was made to fortify it. The town is populous and handsome; the streets are well paved, and tolerably clean at all times; and the houses, though not stately, make a very decent appearance. Both the streets and houses are, for the greater part, disposed in a regularity of plan, which proves them not to be of the most remote [illegible]ron's [illegible]our. antiquity. It is indeed true that the level situation, being singularly favourable to regularity, might, even from the first, give this an advantage over many of our old boroughs. Several streets run in a direction parallel with the river, as far as a right line can bear this relation to a curve line, nearly between east and west: these are again intersected by others extending between north and south. It should seem that anciently particular streets were inhabited, each by a particular class of artisans. The names still preserved seem to indicate as much. The shop-keepers or merchants occupied one street; the hammermen a second; and other crafts occupied, in the same manner, each a separate street. Many of the houses in that street called the *Water-gate*, seem to be very old buildings. Towards the south end of the Water-gate stands the famous palace of the Gowrie family. The house, and the very room, where the attempt of the Gough's Camden. Gowries to seize or assassinate the king was supposed to have been made, is now converted into barracks for a train of artillery; but the back-stair, down which the Ruthvens were thrown, is pulled down. This strange event, however magnified or attested by contemporary writers, is made up of so many improbabilities, or circumstances for which no reason can be assigned, that Sir David Dalrymple, in republishing the account printed by authority, 1600, preparatory to his further observations on it, seems justified in absolutely discrediting a fact which passed for problematical with so many persons at the very time. Dr Robertson supposes it a plot of Elizabeth to get James into her power. Mr Cant having discussed the whole story of the conspiracy in his Muse's Threnodie, p. 185—261, concludes, "that as this would have been a very impolitic measure, the best way of accounting for it is by James's known hatred to the Puritans, and wish to get rid of two popular characters." The king had been seized and forced from his favourites by the father of the Ruthvens 12 years before (1582), and though he affected to forgive him, took Perth. the first opportunity to condemn and execute him as a traitor, 1584. Mr Camden was too good a courtier to speak with impartiality of any part of this weak monarch's conduct. Though the name of *Gowrie* was abolished, the title of *Ruthven* was revived in the person of Sir Thomas Ruthven of Freeland, whom Charles II. 1651, created Lord Ruthven: but the honour, on the death of his son David in 1704, devolved on Isabel, surviving daughter of his second sister, who married Sir Francis Ruthven, and was succeeded, 1732, by his son James.

The castle of Perth stood near the red bridge, which terminated the narrow street called *Skinner-gate*. At the end of the Castle-street another narrow street leads west to the Black-friars, called *Couvre feu-row*, where the curfeu bell was. The kings of Scotland before James II. were crowned at Scone, and resided at Perth as the metropolis of the nation. James resided and was educated in the castle of Edinburgh, and was crowned there 1437. The parliaments and courts of justice were removed from Perth to Edinburgh, but Perth kept its priority till 22 James III. 1482.

The church in which John Knox harangued is still standing, and is now divided into three; named the *east*, the *middle*, and the *west* kirks. The east kirk was lately very handsomely modernised within. There is an old hospital, a considerable building, the founding of which is ascribed to James VI. The town-house shuts up the eastern end of the High-street. A monastery of Carthusians was here established by King James I. of Scotland, who lost his life on the very spot, by the treachery of Athol and his accomplices. The king was buried in a very stately monument in this place, which was called *monasterium vallis virtutis*, one of the most magnificent buildings in the kingdom, which with the rest was destroyed by the populace. James VI. created George Hay commendator of the Carthusian priory, giving him all its emoluments, with a vote and seat in parliament; but these not being sufficient to support the title, he surrendered it back to the king. The only remains of this magnificent structure is to be seen in the carved stones with which the south east porch of St John's church is built, now greatly decayed. The king's garment full of stabs was preserved here after the reformation.

The town was anciently provided with a stone bridge over the river, which an inundation swept away; but a new and very fine one has lately been built, the most beautiful structure of the kind in North Britain, and was designed and executed by Mr Smeaton. Its length is 900 feet; the breadth (the only blemish) 22 within the parapets. The piers are founded 10 feet beneath the bed of the river, upon oaken and beechen piles, and the stones laid in puzzolano, and cramped with iron. There are nine arches, of which the centre is 75 feet in diameter. This noble work opens a communication with all the different great roads of the kingdom, and was completed at the expence of 26,000l. Of this the commissioners of forfeited estates, by his majesty's permission, gave 11,000l.; Perth 2000l.; private subscribers 4756l.; the royal boroughs 500l. But still this great work would have met with a check for want of money, had not the earl of Kinnoul, with his characteristic public spirit, advanced the remaining sum, and taken the security of the tolls, at his own hazard. The whole expence has now been defrayed, and the toll has ceased.

This town has but one parish, which has two churches, besides meetings for separatists, who are very numerous. One church, which belonged to a monastery, is very ancient: not a vestige of the last is now to be seen; for the disciples of Knox made a general desolation of every edifice that had given shelter to the worshippers of the church of Rome; it being one of his maxims, to pull down the nests, and then the rooks would fly away.

The flourishing state of Perth it is said was originally owing to numbers of Cromwell's wounded officers and soldiers choosing to reside here, after he left the kingdom, who introduced a spirit of industry among the people. But this town, as well as all Scotland, dates its prosperity from the year 1745; the government of this part of Great Britain having never been settled till a little after that time.

That this town does not owe its origin to William I. 1210, as Boethius says, is evident from its being mentioned as a considerable place in the foundation charter of Holyroodhouse by David I. 1128.

The population of Perth in 1791 is said to have been nearly 20,000: but it is supposed that it has since increased to 22,000. The returns of the population, however, in the census for 1801, are only 14,878, and for 1811, 16,948.

The trade of Perth is considerable. Its staple manufacture is linen, but of late the cotton manufacture has almost superseded it. It exports annually 150,000l. worth of linen, from 24,000 to 30,000 bolls of wheat and barley to London and Edinburgh, and a very large quantity of cured salmon. That fish is taken there in vast abundance; 3000 having been caught in one morning; weighing, one with another, 16 pounds; the whole capture 48,000 pounds. The fishery begins on St Andrew's day, and ends August 26th old style. The rents of the fisheries amount to considerably upwards of 3000l. per annum. Smelts come up this river in May and June. W. Long. 3. 27. N. Lat. 56. 22.

Perth Amboy. See *New Jersey*.

PERTINAX, was an illustrious Roman emperor after the death of Commodus. He was descended of a mean family; and like his father, who was either a slave or the son of a manumitted slave, he for some time followed the employment of drying wood and making charcoal. His poverty did not, however, prevent him from receiving a liberal education. For some time he was employed in teaching a number of pupils the Greek and the Roman languages in Etruria. He left this laborious profession and became a soldier, and by his valour and intrepidity gradually rose to offices of the highest trust in the army, and was made consul by M. Aurelius for his services. He was afterwards entrusted with the government of Mœsia, and at length he presided over the city of Rome as governor. When Commodus was murdered, Pertinax was universally chosen to succeed to the imperial dignity; and his refusal, on the plea of old age, and increasing infirmities, did not prevent his being saluted emperor and Augustus. He complied with reluctance; but his mildness, his economy, and popularity, convinced the senate and the people of the prudence and the justice of their choice. He forbade his name to be inscribed on such places or estates as were part of the imperial domains, and asserted that they belonged not to him but to the public. He melted all the silver statues which had been raised to his predecessor, and he exposed to sale all his concubines, horses, arms, and all the instruments of his pleasure and extravagance. With the money raised from these relics he enriched the empire, and was enabled to abolish all the taxes which Commodus had laid on the rivers, ports, and highways, through the empire. These patriotic actions gained him the affection of the worthiest and most deserving of his subjects; but the extravagant, luxurious, and vicious, raised their clamours against him; and when the emperor attempted to introduce among the prætorian guards such discipline as was absolutely necessary to preserve the peace and tranquillity of Rome, the flames of rebellion were kindled, and the minds of the soldiers totally alienated. Pertinax was apprized of their mutinying, but he refused to fly at the hour of danger. He scorned the advice of such of his friends as wished him to withdraw from the impending storm; and he unexpectedly appeared before the seditious troops, and without fear or concern boldly asked them, whether they who were bound by duty to defend the person of their prince and emperor, were come to betray him and to shed his blood? His undaunted courage and intrepidity would have had the desired effect, and the soldiers had begun to retire, when one of the most seditious of them advanced and darted his javelin at the emperor's breast, exclaiming, *The soldiers send you this*. The rest instantly followed the example; and Pertinax, muffling up his head, and calling upon Jupiter to avenge his death, remained unmoved, and was immediately dispatched. His head was cut off and carried upon the point of a spear in triumph to the camp. This abominable murder happened in the 193d year of the Christian era.

It was no sooner known that Pertinax had been murdered, than the enraged populace flocked from all quarters of the city; and uttering dreadful menaces against the authors of his death, ran up and down the streets in quest of them. The senators were no less concerned for his death than the people; the more, because they were now convinced, that the soldiers would suffer none to reign but tyrants. However, as they had more to lose than the common people, they did not offer to revenge his death; but either shut themselves up in their own houses, or in those of the soldiers of their acquaintance, thinking themselves there more safe. Such was the unfortunate and much-lamented end of Publius Helvius Pertinax, after he had lived 66 years 7 months and 26 or 28 days; and reigned, according to Dio Cassius, 87 days, that is from the 1st of January to the 28th of March. His body, together with his head, was interred with great pomp by Didius Julianus, his successor, in the burying-place of his wife's family. The emperor Septimius Severus, with the title of emperor, assumed the name of Pertinax, which he knew would above any thing else recommend him to the army in Illyricum, and to the Roman people. He punished with great severity all those who had been accessary to his death, disbanded the prætorian guards, honoured his memory with a most magnificent funeral, at which was carried the effigies of the deceased prince, pronounced his panegyric, and caused him to be ranked in the number of the gods, appointing the son chief priest to his father. The day of his accesion to the empire was yearly celebrated with the Circensian games; and his birthday, for many years after, with other sports. He performed great things, says Herodian, during his short administration, and would have restored the empire to its former lustre, had he been indulged with a longer reign.

PERTINENT OF LANDS, in *Scots Law*. See LAW, N° clxvii. 6. p. 670.

PERU.

PERU, a country of South America, is bounded on the north by Popayan, on the east by Amazonia, on the south by Chili, and on the west by the Pacific ocean; extending from 1° 40′ north to 26° 10′ south latitude, and between 56° and 81° west longitude from Greenwich; being about 1800 miles in length.

1 **How discovered by the Spaniards.**

This country was discovered by the Spaniards; and the first intelligence they had of it was on the following occasion. Nunez de Balboa having been raised to the government of the small colony at Santa Maria in Darien, made frequent inroads into the adjacent country, subdued several of the caciques or petty princes, and collected a considerable quantity of gold. In one of these expeditions, the Spaniards contended so violently about the division of some gold which they had taken, that they were on the point of coming to blows with one another. A young cacique who was present, astonished at such contention about a thing of which he knew not the use, tumbled the gold out of the balance with indignation, and turning to the Spaniards, told them, that since they valued gold so very highly, he would conduct them to a country near the southern ocean, where the most common utensils were made of that metal.

2 **Difficulties they had to overcome.**

Balboa was transported at the news. He immediately concluded, that the ocean mentioned by the cacique was that which Columbus had so long sought for in vain, and that the rich territory described to him must be part of the East Indies. He was therefore impatient till he should arrive at that happy country, in comparison with the discovery of which all former exploits almost vanished into nothing. In order therefore to procure a force sufficient to ensure success in his enterprise, he first secured the friendship of the neighbouring caciques, and then dispatched some of his officers to Hispaniola, with a large quantity of gold as a proof of his past success, and an earnest of what he expected. By this means he secured the friendship of the governor, and procured a considerable reinforcement. But though he now imagined himself sufficiently strong to attempt the discovery, there were still prodigious difficulties to be surmounted. The isthmus of Darien, though not above 60 miles in breadth, has a chain of lofty mountains running through its whole extent. Being situated between two vast oceans, the Atlantic and Pacific, the climate is excessively moist, insomuch that it rains for two-thirds of the year. In consequence of this the valleys are marshy, and so frequently overflowed, that the inhabitants find it necessary in some places to build their houses upon trees, in order to be elevated at some distance from the damp soil, and the odious reptiles engendered in the waters. There are also many large rivers very difficult to be crossed; and as the country at that time was only inhabited by a few wandering savages, the enterprise of Balboa was looked upon as the most difficult that had been undertaken by any Spanish adventurer.

On this arduous task Balboa set out on the 1st day of September 1513, about the time that the periodical rains began to abate. He had only 190 Spaniards along with him; but all of them were hardy veterans, inured to the climate of America, and very much attached to their leader. A thousand Indians attended in order to carry their provisions and other necessaries; and they had along with them some of those fierce dogs so terrible to the natives of America.

3 **Balboa first gets a sight of the South sea.**

Balboa proceeded by sea, and without difficulty, to the territories of a cacique whose friendship he had gained; but as soon as he began to advance into the interior parts of the country, he met with all the difficulties above mentioned. Some of the caciques also, at his approach, fled with all their people to the mountains, carrying off or destroying whatever could afford subsistence to an army. Others collected their force in order to oppose him: however, Balbao continued unmoved in spite of all difficulties, and at last, after a most painful journey of 25 days, he arrived at the South sea; when, with the most extravagant transports of joy, he went into it up to the middle, and took possession of the ocean in his master's name, vowing to defend it against all the enemies of Spain.

4 **He is deprived of his command,**

That part of the South sea which Balboa now discovered, he called the *Gulf of St Michael;* which name it still retains, and is situated to the east of Panama. From some of the neighbouring caciques he extorted provisions and gold by force; others sent him presents voluntarily; and he had the satisfaction to hear, that the adjacent coasts abounded with pearl-oysters. The inhabitants were also unanimous in declaring, that there was to the southward a very rich and populous country, where the people had tame animals, which they endeavoured to describe to him, meaning the Peruvian sheep. But, however, impatient he might be to visit this empire, he considered it as highly improper to venture thither with a handful of men exhausted by labour and disease. He therefore led back his followers to Santa Maria, in order to refresh them after their fatigues; and from thence he sent an account to the court of Spain of the important discovery he had made, demanding a reinforcement of 1000 men, in order to conquer the country he had newly discovered. But here his hopes were all blasted at once. The king indeed determined to prosecute the discovery, but refused to continue Balboa in his government, appointing Pedrarius Davila to supersede him, and giving him the command of 15 stout vessels, with 1200 soldiers, to ensure his success.

Balboa, though much mortified by his disgrace, submitted to the king's pleasure without repining. It was not long, however, before he met with an additional misfortune; the new governor tried him for some pretended irregularities committed before his arrival, and fined him of almost all he was worth. In the mean time the Spaniards, paying no regard to the treaties concluded by Balboa with the Indians, plundered and destroyed all indiscriminately, insomuch that the whole country, from the gulf of Darien to the lake Nicaragua, was desolated. The new comers had also arrived at the most unlucky time of the year, namely, about the middle of the wet season, when the excessive rains produced the most violent and fatal diseases. To this was joined an extreme scarcity of provisions; so that in the space of a month above 600 Spaniards perished in the utmost misery.

Balboa failed not to send violent remonstrances to Spain against the conduct of the new governor; and he, on the other hand, accused his antagonist of having deceived the king by false accounts of the country, and magnifying his own exploits beyond measure. At last the king, sensible of his error in superseding Balboa, appointed him adelantado, or lieutenant-governor of the countries on the South sea, with very extensive privileges and authority; enjoining Pedrarias to support him in all his enterprises, and to consult with him in every thing which he himself undertook. It was impossible, however, to extinguish the envy of Pedrarias; and therefore, though a reconciliation took place in appearance, even so far, that Pedrarias agreed to give his daughter in marriage to Balboa, yet he soon after had him condemned and executed on pretence of disloyalty, and an intention to revolt from the king.

5
And put to death.

On the death of Balboa, the thoughts of conquering Peru were for a time laid aside; however, it still remained an object of desire to all the Spanish adventurers in America. Accordingly, several armaments were fitted out with a design to explore and take possession of the countries to the east of Panama; but, either through the difficulties which attended the undertaking itself, or the bad conduct of the adventurers, all of them proved unsuccessful, until at last it became a general opinion, that Balboa's scheme had been entirely visionary.

6
A new expedition set on foot.

Still, however, there were three persons settled at Panama, on whom the common opinions made so little impression, that they determined to go in quest of this country, looked upon to be chimerical by the generality of their neighbours. Their names were *Francisco Pizarro, Diego de Almagro*, and *Hernando Luque*. Pizarro and Almagro were soldiers of fortune, and Luque was an ecclesiastic, who acted both as priest and schoolmaster at Panama. Their confederacy was authorised by Pedrarias governor of Panama; and each engaged to employ his whole fortune in the adventure. Pizarro, being the least wealthy of the three, engaged to take upon himself the greatest share of the fatigue and danger, and to command in person the armament which was to go first upon the discovery. Almagro offered to conduct the supplies of provisions and reinforcements of troops which might be necessary; and Luque was to remain at Panama, in order to negociate with the governor, and to superintend whatever was carrying on for the general interest.

7
Meets with bad success at first.

In 1524, Pizarro set sail from Panama with a single vessel of small burthen and 112 men; and so little was he or his countrymen at that time acquainted with the climate of America, that the most improper season of the whole year was chosen for his departure: the periodical winds, which were then set in, being directly opposite to the course which he proposed to steer. The consequence of this was, that, after beating about for 70 days with much danger and fatigue, he had advanced scarce as far to the south-east as a skilful navigator will now make in three days. He touched at several places of Terra Firma; but finding that country exceedingly inhospitable and unhealthy, he was obliged to retire to Chuchama, opposite to the Pearl islands, where he hoped to receive some reinforcements from Panama. Here he was found by Almagro, who had set out in quest of him with a reinforcement of 70 men, and had suffered distresses very much resembling those of Pizarro himself. In particular, he had lost an eye in combat with the Indians. However, he had advanced as far as the river of St Juan in the province of Popayan, where the country showing a better aspect, and the inhabitants more friendly, our projectors again began to indulge themselves in hopes, and determined by no means to abandon their scheme.

Almagro returned to Panama, in hopes of recruiting their shattered troops. But the bad accounts of the service gave his countrymen such an unfavourable idea of it, that Almagro could levy no more than 80 men, and these with great difficulty. Slender as this reinforcement was, however, the adventurers did not hesitate at renewing their enterprise. The disasters and disappointments they met with in this new attempt, were scarcely inferior to those they had already experienced, when part of the armament at last reached the bay of St Matthew on the coast of Quito, and landed at Tacamez to the south of the river of Emeralds, where they met with a more fertile and champaign country than any they had yet seen; the natives also were more civilized, and clothed in garments of cotton or woollen stuff, adorned with trinkets of gold and siver. But notwithstanding these favourable appearances, Pizarro did not think fit to attack such a powerful empire with a handful of soldiers already exhausted; and therefore retired to a small island called Gallo, with part of the troops; from whence he dispatched Almagro to Panama, in hopes of obtaining a reinforcement.

The reception which Almagro met with was by no means agreeable. Some of the adventurers had informed their friends of the many dangers and losses which they had sustained; which not only disheartened people from engaging in the service, but weighed so much with Pedro de los Rios, the successor of Pedrarias, that he prohibited the raising of new recruits, and even dispatched a vessel to bring home Pizarro and his companions from the island of Gallo. Almagro and Luque, though much mortified with this disappointment, privately advised Pizarro not to relinquish an enterprise on which they had built all their hopes. He therefore positively refused to obey the orders of the governor, and employed all his address in persuading his men not to abandon him. But the calamities to which they had been exposed had such an effect upon them, that when he drew a line upon the sand with his sword, telling such as wished to return that they might pass over it, only 13 had resolution to remain with him.

8
Pizarro abandoned by all his men but thirteen.

9 Goes on with his scheme at all adventures.

Pizarro with his little troop now fixed their residence on the isle of Gorgona, which they considered as a safer retreat than Gallo, as being farther removed from the coast, and uninhabited, so that they might with the greater security wait for supplies. Here they continued five months in the most unwholesome climate imaginable, and at last had come to a resolution of committing themselves to sea on a float, when a vessel arrived from Panama to their relief. This was the effect of the continued solicitations of Almagro and Luque; who, though they could not prevail upon the governor to favour the undertaking, had succeeded so far as to induce him to send a small vessel to the relief of Pizarro and his unfortunate associates. However, the more effectually to show his disapprobation of Pizarro's scheme, the governor refused to allow one landman to go on board of the ship which he sent.—The hopes of the adventurers were now again revived, and Pizarro easily induced them to resume their scheme. Instead of returning to Panama, therefore, they sailed to the south-east, and in 20 days after the discovery of Gorgona, they discovered the coast of Peru. Having touched at some places of less note, they at length arrived at Tumbez, remarkable for its stately temple, and a palace of the incas or sovereigns of the country. Here they found that what had been told them concerning the riches of the country was true; not only ornaments and sacred vessels being made of gold and silver, but even such as were for common use. Yet to attempt the conquest of this opulent empire with their slender force, would have been madness; they contented themselves therefore with viewing it, procuring two of the beasts of burthen called *llamas*, to which they gave the name of sheep, some vessels of gold and silver, and two young men, whom they proposed to instruct in the Castilian language. With these Pizarro arrived at Panama in the year 1527, near three years after he had set out from that place on his expedition.

10 History of the Incas of Peru.

The empire of Peru, thus discovered, is said to have been originally possessed by independent tribes, justly reckoned among the most savage even in America; living more like wild beasts than men. For several ages they lived in this manner, when suddenly there appeared on the banks of a lake called *Titiaca*, a man and woman of majestic form, and clothed in decent garments. They declared themselves to be the children of the sun, sent by their beneficent parent to instruct and reclaim mankind.

The names of these two extraordinary personages were *Manco Capac* and *Mama Ocla*. At their persuasion, several of the dispersed savages united, and, receiving their commands as heavenly injunctions, followed them to Cuzco, where they settled, and began to lay the foundations of a city. Manco Capac instructed the men in agriculture, and other useful arts; while Mama Ocla taught the women to spin and weave; after which Manco turned his attention towards the introduction of proper laws and regulations into his new state.

Thus, according to the Indian tradition, was founded the empire of the Incas, or lords of Peru. At first its extent was small, the territory of Manco Capac reaching not above eight leagues from Cuzco his capital. Within these narrow limits, however, he exercised the most perfect despotism, and the same was maintained by his successors, all of whom were not only obeyed as monarchs, but reverenced as deities. Their blood was held to be sacred, and, by prohibiting intermarriages with the people, was never contaminated by mixing with that of any other race. The family, thus separated from the rest of the nation, was distinguished by peculiarities in dress and ornaments, which it was unlawful for others to assume. Among the Peruvians, however, it is said, that this high degree of veneration was made use of by the monarchs only to promote the good of their subjects. If we may believe the accounts given by their countrymen, the Peruvian monarchs extended their empire not with a view to increase their own power and wealth, but from a desire of diffusing the blessings of civilization, and the knowledge of the arts which they possessed, among the barbarous people whom they reduced, and, during a succession of 12 monarchs, not one deviated from this character.

Carver's Modern General Traveller.

11 Religion of the Peruvians.

The Peruvians were taught by Manco to adore the Creator of heaven and earth, whom they denominated *Paça Camac*, that intelligence which animated the world. They seldom built temples or offered sacrifices to him, but worshipped him in their hearts. One temple, however, dedicated to *The unknown God*, the Spaniards found at their arrival, erected in a valley, thence named *the valley of Paca Camac*. The sacrifices instituted in honour of the sun consisted chiefly of lambs; besides which they offered all sorts of cattle, fowls, and corn, and even burnt their finest cloths on the altar by way of incense. They had also drink offerings made of maize or Indian corn, steeped in water. Nor were those oblations the only acts of adoration in general use among them. When they first drank after their meals, they dipped the tip of their finger into the cup, and lifting up their eyes with great devotion, gave the sun thanks for their liquor, before they presumed to take a draught of it.

Besides the worship of the sun, they paid some kind of veneration to the images of several animals and vegetables that had a place in their temples. These were generally the images brought from the conquered nations, where the people worshipped all sorts of creatures, animate or inanimate; it being the custom, when a province was subdued, to remove all their idols to the temple of the sun at Cuzco.

Exclusive of the solemnities at every full moon, four grand festivals were celebrated annually. The first of those, called *Raymi*, was held in the month of June, immediately after the summer solstice, and was kept not only in honour of the sun, but of their first Inca, Manco Capac, and Coya Mama Ocla, his wife and sister, whom the Incas considered as their first parents, descended immediately from the sun, and sent by him into the world to reform and polish mankind. At this festival, all the viceroys, generals, governors, and nobility, were assembled at the capital city of Cuzco; and the emperor, or Inca, officiated in person as high-priest; though on other occasions the sacerdotal function was discharged by the regular pontiff, who was usually either the uncle or brother of the Inca.

The morning of the festival being come, the Inca, accompanied by his near relations, drawn up in order according to their seniority, went barefoot in procession, at break of day, to the market-place, where they remained looking attentively towards the east in expectation of the rising sun. The luminary no sooner appeared, than they fell prostrate on their faces in the most profound veneration, and universally acknowledged it to be their god and father.

The vassal princes, and nobility, that were not of the blood royal, assembled in another square, and performed the like ceremony. Out of a large flock of sheep the priests then chose a black lamb, which they offered in sacrifice, first turning its head towards the east. From the entrails of the victim, on this occasion, they superstitiously drew prognostics relating to peace and war, and other public events.

That the Peruvians believed in the immortality of the soul, appears from the practice of the Incas, who constantly inculcated to the people, that, on leaving this world, they should enter into a state of happiness provided for them by their god and father the sun.

12 They were acquainted with astronomy before the arrival of the Spaniards.

Before the arrival of the Spaniards in America, the Peruvians were acquainted with some points of astronomy. They had observed the various motions of the planet Venus, and the different phases of the moon. The common people divided the year only by the seasons; but the Incas, who had discovered the annual revolution of the sun, marked out the summer and winter solstices by high towers, which they erected on the east and west of the city of Cuzco. When the sun came to rise directly opposite to four of those towers, on the east side of the city, and to set against those of the west, it was then the summer solstice; and in like manner, when it rose and set against the other towers, it was the winter solstice. They had also erected marble pillars in the great court before the temple of the sun, by which they observed the equinoxes. This observation was made under the equator, when the sun being directly vertical, the pillars cast no shade. At those times they crowned the pillars with garlands of flowers and odoriferous herbs, and celebrating a festival, offered to their adored luminary rich presents of gold and precious stones.

They distinguished the months by the moon, and their weeks were called quarters of the moon; but the days of the week they marked only by the ordinal numbers, as first, second, &c. They were astonished at the eclipses of the sun and moon. When the former hid his face, they concluded it was on account of their sins, imagining that this phenomenon portended famine, war, and pestilence, or some other terrible calamity. In a similar state of the moon, they apprehended that she was sick, and when totally obscured, that she was dying. At this alarming crisis they sounded their trumpets, and endeavoured by every kind of noise to rouse the lunar planet from her supposed lethargy; teaching their children to cry out, and call upon *mama quilla*, or "mother moon," that she would not die and leave them to perish.

They made no predictions from any of the stars, but considered dreams, and the entrails of beasts which they offered in sacrifice, as instructive objects of divination. When they saw the sun set, they imagined that he plunged into the ocean, to appear next morning in the east.

13 They had teachers of morality;

Among a people wholly void of letters, the speculative essays of the understanding must have been very rude and imperfect. They had, however, among them amentas, or philosophers, who delivered moral precepts, and likewise cultivated poetry. Comedies and tragedies composed by those bards were acted on their festivals before the king and the royal family, the performers being the great men of the court, and the principal officers of the army. The amentas also composed songs and ballads, but if we may judge from the rudeness of the music with which they are said to have been accompanied, they were far from being agreeable to a polished ear.

14 and were not unacquainted with painting and statuary.

That the Peruvians were not unacquainted with painting and statuary, appears from the furniture and ornaments of their temples and palaces; but in all the implements of mechanic arts they were extremely deficient. Though many goldsmiths were constantly employed, they had never invented an anvil of any metal, but in its stead made use of a hard stone. They beat their plate with round pieces of copper in place of hammers; neither had they any files or graving tools. Instead of bellows for melting their metals, they used copper pipes, of a yard long, almost of the form of a trumpet. Having no tongs to take their heated metal out of the fire, they made use of a stick or copper bar. Their carpenters had no other tools than hatchets made of copper or flint; nor had they learned the use of iron; though the country affords mines of that metal. Instead of nails, they fastened their timber with cords or the tough twigs of trees. A thorn, or a small bone, served them for a needle; and instead of thread, the sinews of animals, or the fibres of some plant. Their knives were made of flint or copper.

15 Progress of the Spaniards facilitated by a civil war among the natives;

When the Spaniards first visited this country, they found it agitated by a civil war. Huana Capac, the 12th monarch from the founder of the state, was seated on the throne; who is represented as a prince no less conspicuous for his abilities in war than for his pacific virtues. By him the kingdom of Quito was subdued, which almost doubled the extent of the dominions and power of the Peruvian empire. Notwithstanding the ancient and fundamental law against polluting the blood of the Inca with any foreign alliance, Huana married the daughter of the conquered monarch, by whom he had a son named *Atahualpa*, commonly written *Atabalipa*, to whom, at his death in 1529, he left the kingdom of Quito, bestowing the rest of his dominions upon Huascar his eldest son by a mother of the royal race. This produced a civil war, in which Atabalipa proved victorious, and afterwards attempted to secure himself on the throne by putting to death all the descendants of Manco Capac, styled *the children of the sun*, whom he could seize either by force or stratagem; however, from a political motive, he spared the life of his rival Huascar, who had the misfortune to be taken prisoner in an engagement, that, by issuing out orders in his name, he might more easily establish his own authority, and cover the illegality of his birth.

This contest had so much engaged the attention of the Peruvians, that they never once attempted to check the progress of the Spaniards. It was some time, however, before Pizarro was informed of this contest, so much in his favour. The first intelligence which he received of it was a message from Huascar, asking his assistance against Atabalipa, whom he represented as a rebel and an usurper. Pizarro perceived the importance of the intelligence, and therefore determined to push forward, while intestine discord put it out of the power of the Peruvians to attack him with their whole force. Being obliged to divide his troops, in order to leave a garrison in St Michael, which might serve for a place of retreat in case of a disaster, he began his march with only 62 horsemen and 102 foot-soldiers, 20 of whom were armed with cross-bows, and only three with muskets. He directed his course towards Caxamalca, a small town at the distance of 12 days march from St Michael, where Atabalipa was encamped with a considerable body of troops. Before he had proceeded far, an officer dispatched by the Inca met him with a valuable present from that prince, accompanied with a proffer of his alliance, and his assurances of a friendly reception at Caxamalca. Pizarro, according to the usual artifice of his countrymen in America, pretended to come as the ambassador of a powerful monarch, and declared that he was now advancing with intention to offer Atabalipa his aid against those enemies who disputed his title to the throne.

16
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As the object of the Spaniards in entering their country was altogether incomprehensible to the Peruvians, they had formed various conjectures concerning it, without being able to decide whether they should consider their new guests as beings of a superior nature, who had visited them from some beneficent motive, or as formidable avengers of their crimes, and enemies to their repose and liberty. The continual professions of the Spaniards, that they came to enlighten them with the knowledge of truth, and lead them in a way of happiness, favoured the former opinion; the outrages which they committed, their rapaciousness and cruelty, were awful confirmations of the latter. While in this state of uncertainty, Pizarro's declaration of his pacific intentions so far removed all the Inca's fears, that he determined to give him a friendly reception. In consequence of this resolution, the Spaniards were allowed to march in tranquillity across the sandy desert between St Michael and Motupè, where the most feeble effort of an enemy, added to the unavoidable distresses which they suffered in passing through that comfortless region, must have proved fatal to them. From Motupè they advanced towards the mountains which encompass the low country of Peru, and passed through a defile so narrow and inaccessible, that a few men might have defended it against a numerous army. But here likewise, from the same inconsiderate credulity of the Inca, the Spaniards met with no opposition, and took quiet possession of a fort erected for the security of that important station. As they now approached near to Caxamalca, Atabalipa renewed his professions of friendship; and, as an evidence of his sincerity, sent them presents of greater value than the former.

On entering Caxamalca, Pizarro took possession of a large court, on one side of which was a house which the Spanish historians call a palace of the Inca, and on the other a temple of the sun, the whole surrounded with a strong rampart or wall of earth. When he had posted his troops in this advantageous station, he dispatched Hernando Soto, and his brother Ferdinand, to the camp of Atabalipa, which was about a league distant from the town. He instructed them to confirm the declaration which he had formerly made of his pacific disposition, and to desire an interview with the Inca, that he might explain more fully the intention of the Spaniards in visiting his country. They were treated with all the respectful hospitality usual among the Peruvians in the reception of their most cordial friends, and Atabalipa promised to visit the Spanish commander next day in his quarters. The decent deportment of the Peruvian monarch, the order of his court, and the reverence with which his subjects approached his person and obeyed his commands, astonished those Spaniards, who had never met in America with any thing more dignified than the petty cacique of a barbarous tribe. But their eyes were still more powerfully attracted by the vast profusion of wealth which they observed in the Inca's camp. The rich ornaments worn by him and his attendants, the vessels of gold and silver in which the repast offered to them was served up, the multitude of utensils of every kind formed of those precious metals, opened prospects far exceeding any idea of opulence that a European of the 16th century could form.

On their return to Caxamalca, while their minds were yet warm with admiration and desire of the wealth which they had beheld, they gave such a description of it to their countrymen, as confirmed Pizarro in a resolution which he had already taken. From his own observation of American manners during his long service in the New World, as well as from the advantages which Cortes had derived from seizing Montezuma, he knew of what consequence it was to have the Inca in his power. For this purpose, he formed a plan as daring as it was perfidious. Notwithstanding the character he had assumed of an ambassador from a powerful monarch, who courted an alliance with the Inca, and in violation of the repeated offers which he had made to him of his own friendship and assistance, he determined to avail himself of the unsuspicious simplicity with which Atabalipa relied on his professions, and to seize his person during the interview to which he had invited him. He prepared for the execution of his scheme with the same deliberate arrangement, and with as little compunction, as if it had reflected no disgrace on himself or his country. He divided his cavalry into three small squadrons, under the command of his brothers Ferdinand, Soto, and Benalcazar; his infantry was formed into one body, except 20 of most tried courage, whom he kept near his own person to support him in the dangerous service which he reserved for himself; the artillery, consisting of two field-pieces, and the cross-bow men, were placed opposite to the avenue by which Atabalipa was to approach. All were commanded to keep within the square, and not to move until the signal for action was given.

17
Perfidious scheme of Pizarro to seize the Inca.

Early in the morning the Peruvian camp was all in motion. But as Atabalipa was solicitous to appear with the greatest splendour and magnificence in his first interview with the strangers, the preparations for this were so tedious, that the day was far advanced before he began his march. Even then, lest the order of the procession should be deranged, he moved so slowly, that the Spaniards became impatient and apprehensive that some suspicion of their intention might be the cause of this delay. In order to remove this, Pizarro dispatched one of his officers with fresh assurances of his friendly disposition. At length the Inca approached. First of all appeared

400 men in an uniform dress, as harbingers to clear the way before him. He himself, sitting on a throne or couch, adorned with plumes of various colours, and almost covered with plates of gold and silver enriched with precious stones, was carried on the shoulders of his principal attendants. Behind him came some chief officers of his court carried in the same manner. Several bands of singers and dancers accompanied this cavalcade; and the whole plain was covered with troops, amounting to more than 30,000 men.

As the Inca drew near the Spanish quarters, Father Vincent Valverede, chaplain to the expedition, advanced with a crucifix in one hand, and a breviary in the other, and in a long discourse explained to him the doctrine of the creation, the fall of Adam, the incarnation, the sufferings and resurrection of Jesus Christ, the appointment of St Peter as God's vicegerent on earth, the transmission of his apostolical power by succession to the popes, the donation made to the king of Castile by Pope Alexander of all the regions in the New World. In consequence of all this, he required Atabalipa to embrace the Christian faith, to acknowledge the supreme jurisdiction of the pope, and to submit to the king of Castile as his lawful sovereign; promising, if he complied instantly with this requisition, that the Castilian monarch would protect his dominions, and permit him to continue in the exercise of his royal authority; but if he should impiously refuse to obey his summons, he denounced war against him in his master's name, and threatened him with the most dreadful effects of his vengeance.

This strange harangue, unfolding deep mysteries, and alluding to unknown facts, of which no power of eloquence could have conveyed at once a distinct idea to an American, was so lamely translated by an unskilful interpreter, little acquainted with the idiom of the Spanish tongue, and incapable of expressing himself with propriety in the language of the Inca, that its general tenor was altogether incomprehensible to Atabalipa. Some parts in it, of more obvious meaning, filled him with astonishment and indignation. His reply, however, was temperate. He began with observing, that he was lord of the dominions over which he reigned by hereditary succession; and added, that he could not conceive how a foreign priest should pretend to dispose of territories which did not belong to him; that if such a preposterous grant had been made, he, who was the rightful possessor, refused to confirm it; that he had no inclination to renounce the religious institutions established by his ancestors; nor would he forsake the service of the sun, the immortal divinity whom he and his people revered, in order to worship the God of the Spaniards, who was subject to death; that with respect to other matters contained in his discourse, as he had never heard of them before, and did not now understand their meaning, he desired to know where he had learned things so extraordinary. "In this book," answered Valverede, reaching out to him his breviary. The Inca opened it eagerly; and turning over the leaves, lifted it to his ear: "This (says he) is silent; it tells me nothing;" and threw it with disdain to the ground. The enraged monk, running towards his countrymen, cried out, "To arms, Christians, to arms; the word of God is insulted; avenge this profanation on those impious dogs."

18 Atabalipa seized by Pizarro.

Pizzaro, who during this long conference had with difficulty restrained his soldiers, eager to seize the rich spoils of which they had now so near a view, immediately gave the signal of assault. At once the martial music struck up, the cannon and muskets began to fire, the horse sallied out fiercely to the charge, the infantry rushed on sword in hand. The Peruvians, astonished at the suddenness of an attack which they did not expect, and dismayed with the destructive effects of the fire-arms, and the irresistible impression of the cavalry, fled with universal consternation on every side, without attempting either to annoy the enemy or to defend themselves. Pizarro, at the head of his chosen band, advanced directly towards the Inca; and though his nobles crowded around him with officious zeal, and fell in numbers at his feet, while they vied one with another in sacrificing their own lives, that they might cover the sacred person of their sovereign, the Spaniards soon penetrated to the royal seat: and Pizarro seizing the Inca by the arm, dragged him to the ground, and carried him as a prisoner to his quarters. The fate of the monarch increased the precipitate flight of his followers. The Spaniards pursued them towards every quarter, and, with deliberate and unrelenting barbarity, continued to slaughter wretched fugitives, who never once offered at resistance. The carnage did not cease until the close of day. Above 4000 Peruvians were killed. Not a single Spaniard fell, nor was one wounded but Pizarro himself, whose hand was slightly hurt by one of his own soldiers, while struggling eagerly to lay hold on the Inca.

19 He offers an immense sum for his liberty.

The plunder taken on this occasion was immense, but the Spaniards were still unsatisfied; which being observed by the Inca, he endeavoured to apply himself to their ruling passion, avarice, in order to obtain his liberty: and therefore offered such a ransom as astonished them, even after all they knew concerning the opulence of the country. The apartment in which he was confined was 22 feet in length and 16 in breadth; and all this space he engaged to fill with vessels of gold as high as he could reach. This proposal was eagerly caught by Pizarro, and a line was drawn upon the walls to mark the stipulated height.

Atabalipa, charmed with the thoughts of liberty, immediately set about performing his part of the agreement, and despatched messengers into all parts of the empire, in order to collect the immense quantity of gold which he had promised; and though the unfortunate monarch was now in the hands of his enemies, such was the veneration which his subjects had for him, that his orders were obeyed with as great alacrity as though he had been at full liberty; while he, in the mean time, flattering himself with the hopes of being soon released, made no preparations for expelling the invaders from his dominions.

In a short time Pizarro received intelligence that Almagro was arrived at St Michael with a reinforcement equal to the force he had with him. This was a matter of great joy to the Spaniards, and no small vexation to Atabalipa, who now considered his kingdom as in danger of being totally overrun by these strangers, whose force he neither knew, nor the means they had of transporting themselves. For this reason he determined to put his brother Huascar to death, lest he should join the strangers against him. To this he was the rather inclined,

clined, as he had got information that the captive prince had been making applications to them, and had offered them a much larger sum than what was stipulated for the Inca's ransom; and in consequence of this determination the unfortunate prince lost his life.

In the mean time the Indians daily arrived at Caxamalca with vast quantities of treasure; the sight of which so much enflamed the Spaniards, that they insisted upon an immediate division: and this being complied with, there fell to the share of each horseman 8000 pesos, at that time not inferior to the value of as many pounds sterling in the present century, and half as much to each foot soldier, Pizarro and his officers receiving shares proportionable to their dignity. A fifth part was reserved for the emperor, together with some vessels of curious workmanship as a present. In consequence of this immense acquisition of wealth, many of the Spaniards became clamorous for their discharge; which was readily granted by their general, as well knowing that the display of their riches would not fail to allure adventurers more hardy, though less opulent, to his standard.

20 izarro reolves to ut the Inca to death.

After this division of the spoil, Atabalipa was very importunate with Pizarro in order to recover his liberty; but the Spaniard, with unparalleled treachery and cruelty, had now determined to put him to death. To this he was urged by Almagro's soldiers, who, though they had received an equal share with the rest, were still unsatisfied. The Inca's ransom had not been completed; and they were apprehensive, that whatever sums might afterwards be brought in, the troops of Pizarro would appropriate them to themselves as part of that ransom. They insisted with Pizarro, therefore, to put him to death, that all the adventurers might for the future be on an equal footing. Accounts were likewise received that troops were assembling in the remote provinces of the empire, which Pizarro suspected to be done by the Inca's orders. These accounts were heightened by one Philipillo an Indian interpreter, who had conceived a passion for one of the unhappy monarch's wives; and for that reason wished to have him put to death. Atabalipa himself, too, had the misfortune to hasten his own ruin by his conceiving a contemptuous notion of Pizarro, which he had not the precaution to conceal. He had, since they were first discovered by him, admired the European arts of reading and writing, and wished much to know whether he should regard it as a natural or acquired talent. In order to determine this, he desired one of the soldiers who guarded him to write the name of God upon the nail of his thumb. This he showed to several Spaniards successively, asking its meaning; and to his surprise, they all returned the same answer. At length Pizarro entered; and, on presenting it to him, he blushed, and was obliged to own his ignorance; which inspired the Inca with the contemptuous notion of him above mentioned.

21 Atabalipa accused and condemned.

In order, however, to give some show of justice to such a detestable action, and that he might be exempted from standing singly as the perpetrator, Pizarro resolved to accuse the Inca of some capital crime, and institute a court of judicature for the purpose of trying him. For this purpose, he appointed himself and Almagro, with two assistants, as judges, with full powers to acquit or condemn: an attorney-general was named to carry on the prosecution in the king's name; counsellors were chosen to assist the prisoner in his defence; and clerks were ordained to record the proceedings of court. Before this strange tribunal a charge was exhibited still more amazing. It consisted of various articles; that Atabalipa, though a bastard, had dispossessed the lawful owner of the throne, and usurped the regal power; that he had put his brother and lawful sovereign to death; that he was an idolater, and had not only permitted, but commanded the offering up of human sacrifices; that he had a great number of concubines; that since his imprisonment, he had wasted and embezzled the royal treasures, which now belonged of right to the conquerors; and that he had excited his subjects to take up arms against the Spaniards. On these heads of accusation they proceeded to try the sovereign of a great empire, over whom they had no jurisdiction. To all these charges the Inca pleaded not guilty. With respect to the death of his brother, he alleged, that the Spaniards could take no cognizance of the fact. With regard to the taxes which he had levied, and the wars he had carried on, they were nothing to the Spaniards; and as to the conspiracy against the Spaniards, he utterly denied it. He called heaven and earth to witness the integrity of his conduct, and how faithfully he had performed his engagements, and the perfidy of his accusers. He desired to be sent over to Spain to take his trial before the emperor; but no regard was paid to his intreaties. He was condemned to be burnt alive; which cruel sentence was mitigated, as a great favour, to strangling; and the unhappy monarch was executed without mercy.

22 and strangled.

23 A general revolt of the Peruvians.

The death of the Inca was followed by a revolution in the Spanish affairs, who now became generally odious. Hideous cries were set up by his women as the funeral procession passed by their apartment; many offered to bury themselves alive with him; and on being hindered, strangled themselves out of grief and vexation. The whole town of Caxamalca was filled with lamentation, which quickly extended itself over the whole kingdom. Friends and enemies accused the Spaniards of inhumanity and treachery. Loads of gold that were coming to Caxamalca by order of the deceased Inca were now stopped; and the loss of the treasure was the first unfortunate consequence which the Spaniards felt from their late iniquitous conduct. The two factions of Indians united against Pizarro; and many of the Spaniards not only exclaimed against the cruelty of the judges, but would even have mutinied, had not a sense of the impending danger kept them quiet. At Cuzco the friends of the emperor Huascar proclaimed Manco Capac the legitimate brother of the late Inca, determining to support him to the last against all the machinations of his enemies. Pizarro, in the mean time, set up Taparpa, the son of Atabalipa, causing him to be treated with all the honours due to an emperor. Immediately he set out for Cuzco, the gaining of which was absolutely necessary for his design. An army of Indians occupied the passes, and resolved to dispute his progress. The contest, however, was soon decided; the Spanish cavalry bore down every thing before them, and great numbers of Indians were slain. The conquerors gained a considerable booty; and Pizarro dispatched Almagro to reduce Cuzco, while he himself founded a new colony in the fruitful valley of Xauna; which, however, was not permanent, being afterwards removed to the place where Lima now stands.

While Pizarro was thus employed, another commander named *Ferdinando Soto*, was detached with 60 horse to make the best of his way to Cuzco, and clear the road for the march of the remainder of the army. He was opposed by a formidable collection of Indians, who had fortified themselves in order to defend a pass against him: for which reason, fearing lest his strength might be unequal, he sent a message to Pizarro, desiring that the Inca might join him, thinking that his presence would awe the Peruvians, and prevent the further effusion of blood; but his expectations were frustrated by the death of the Inca, which happened about this time; so that there was now a necessity for having recourse to arms; for as the Spaniards set up no person in his room, the title of Manco Capac was universally acknowledged.

In the mean time, a new supply of soldiers arriving from Spain, Benalcazar, governor of St Michael, undertook an expedition against Quito, where, according to the reports of the natives, Atabalipa had left the greatest part of his treasure. He accomplished his purpose with very great difficulty, having a country covered with rocks and mountains to pass, and being opposed by large bodies of the natives. But when he got possession of the city, to his extreme mortification, he found that the inhabitants had carried off all their gold and silver; for they being now acquainted with the ruling passion of the Spaniards, had taken care to disappoint it, by removing the treasures which they knew very well had been the cause of the expedition.

24
Chili invaded by Alvarado.

25
He is obliged by Pizarro to abandon the enterprize.

About the same time Alvarado governor of Guatimala, invaded the province of Chili. In this expedition his troops endured such hardships, and suffered so much from the cold among the Andes, that a fifth part of the men and all the horses died, and at the same time the rest were so much dispirited and emaciated, that they became quite unfit for service. What was worst of all, when they had arrived at the end of their journey, they met with a body of Spaniards drawn up in hostile array to oppose them. These had been sent against him by Pizarro, who claimed Chili as part of his jurisdiction, and were now joined by Benalcazar, with the troops under his command. Alvarado, however, advanced boldly to the attack; but on the interposition of some moderate men in each party, the difference was accommodated. Alvarado engaged to return to his government, upon his being paid 100,000 pesos to defray the expence of his armament. However, most of his followers remained in the country, and enlisted in the service of Pizarro.

26
Honours conferred on Pizarro by the court of Spain.

In the mean time Ferdinand Pizarro, the brother of the general, had landed in Spain, where he produced such immense quantities of gold and silver as astonished the court, even after all they had seen of the wealth of their new discovered territories. The general's authority was confirmed to him, with new powers and privileges, and the addition of 70 leagues extending along the coast, to the southward of the territory granted in his former patent. Almagro had the title of *adelantado* or *governor* conferred upon him, with jurisdiction over 200 leagues of a country lying southward from the province allotted to Pizarro; he himself was made a knight of the order of St Jago.

Of these transactions some accounts were received at Peru before the arrival of Ferdinand Pizarro himself; and no sooner did Almagro hear that he had obtained the royal grant of an independent government, than, pretending that Cuzco, the capital of all Peru, lay within his jurisdiction, he attempted to seize it. Pizarro was no less ready to oppose him; and a very dangerous civil war was about to take place, when the quarrel was made up, on condition that Almagro should attempt the conquest of Chili; and if he did not find there an establishment equivalent to his expectations, Pizarro should yield up to him part of Peru.

By this reconciliation Pizarro was left at liberty to settle the internal policy of his province, which, though little qualified for a legislator, he attempted, by dividing the country into various districts, appointing magistrates to preside in each, and establishing such regulations concerning the administration of justice, the royal revenue, &c. as occurred to him. The seat of government he removed from Cuzco to Lima, which he named *Ceudad des los Reyes*, and which name it still retains among the Spaniards in all legal and formal deeds. Its other name, *Lima*, is a corruption of *Rimac*, the name of the valley in which the city stands.

27
A dreadful insurrection of the Peruvians.

In the mean time Almagro had set out on his expedition to Chili; the event of which has been related under the article CHILI; and while he was thus employed, Pizarro encouraged some of his most distinguished officers to invade those provinces of the empire which had not yet been visited by the Spaniards. This he did with a view to keep them employed, and prevent tumults; but it was attended with very terrible consequences. No sooner did Manco Capac the Inca perceive the security of the Spaniards in thus dividing their forces, than he seized the opportunity of making one vigorous effort to redress the wrongs of himself and his countrymen, and expel the invaders, who had tyrannized in such a cruel manner. Though strictly guarded by the Spaniards, he found means to communicate his intentions to the chief men of his nation, whom he joined in the year 1536, under pretence of celebrating a festival which he had obtained liberty from Pizarro to attend. Upon this the standard of war was immediately erected, and a most formidable army, according to the Spanish historians, of 200,000 men collected. Many Spaniards were massacred in their habitations, and several detachments entirely cut off; and while this vast army laid siege to Cuzco, another formidable body invested Lima, and kept the governor closely shut up. The greatest effort, however, was made against Cuzco, which was defended by Pizarro and his two brothers, with only 170 men. The siege lasted nine months; many of the Spaniards were killed; among whom was Juan Pizarro, the general's brother, and the best beloved of them all. The rest were reduced to the most desperate situation, when Almagro appeared suddenly in the neighbourhood of Cuzco. He had received such accounts of the insurrection in Peru, as would at any rate have determined him to return to the assistance of Pizarro; but besides this, he had now received the royal patent, creating him governor of Chili, and deemed it certain beyond all contradiction, that Cuzco lay within his jurisdiction; for which reason he hastened to prevent it from falling into the hands of the Peruvians. On his arrival his assistance was solicited by both parties. The Inca made many advantageous proposals; but at length despairing of obtaining any cordial union with a Spaniard, he attacked him in the night by surprise with a great body of chosen troops. But the Spanish valour and discipline prevailed against the numbers of their enemies; and the Peruvians were repulsed with such slaughter, that a great part of the remainder dispersed, and Almagro advanced to the gates of Cuzco without opposition. Pizarro's brothers took measures to oppose his entrance; but prudence for the present restrained both parties from entering into a civil war while they were surrounded with enemies; and therefore each leader endeavoured to corrupt the followers of his antagonist. In this Almagro had the advantage; and so many of Pizarro's troops deserted in the night, that Almagro was encouraged to advance towards the city, where he surprised the centinels, and investing the house where the two brothers were lodged, he compelled them, after an obstinate defence, to surrender at discretion; and Almagro's authority over Cuzco was immediately recognized as authentic.

28
They are defeated, and dispersed.

29
Civil war between Pizarro and Almagro.

In this fray only two or three persons were killed; but matters soon began to wear a more serious aspect. Francis Pizarro, having dispersed the Peruvians who invested Lima, and received considerable reinforcements from other provinces, ordered 500 men under the command of Alonso de Alvarado to march to Cuzco, in hopes of relieving his brothers, if they were not already cut off. They advanced to a small distance from the capital, before they knew that they had a more formidable enemy than the Indians to encounter. When they saw their countrymen drawn up on the banks of a river to oppose them, they were greatly surprised; however, Almagro, who wished rather to gain them than to fight, began with attempting to seduce their leader. Alvarado could not by any means be gained over; but being inferior in military skill, Almagro attacked him by surprise, entirely defeated and dispersed his army, taking himself and some of his principal officers prisoners.

This victory seemed decisive; and Almagro was advised to make it so by putting to death Gonzalo and Ferdinand Pizarro, Alvarado, and some others whom he could not hope to gain. This advice, however, he declined from motives of humanity, and a desire of making his adversary appear the agressor. For these reasons, instead of marching directly against Pizarro, he retired quietly to Cuzco; which gave his adversary time to recollect himself from the disorder into which the news of so many disasters had thrown him. He began again to practise upon Almagro those arts which had before proved successful; and Almagro again suffered himself to be deceived by pretended offers of pacification. The negotiations for this purpose were protracted for several months; and while Almagro was employed in detecting and eluding the fraudulent intentions of the governor, Gonzalo Pizarro and Alvarado found means to corrupt the soldiers who guarded them, and not only made their own escape, but persuaded 60 of Almagro's men to accompany them. There now remained only Ferdinand Pizarro in the hands of Almagro; and he was delivered by another act of treachery. The general proposed that all points of controversy should be submitted to the decision of their sovereign: and that Ferdinand Pizarro should be instantly set at liberty, and return to Spain, together with some officers whom the general proposed to send over to show the justice of his claims. Though the intention of Pizarro by making this proposal was evident, Almagro was deceived by it, and released those whom Pizarro wanted; which he had no sooner done, than the latter threw off all disguise, and openly declared, that arms alone must now decide the matter between them. He therefore immediately set out for Cuzco with an army of 700 men, to which Almagro had only 500 to oppose. From the weakness of his forces, probably, Almagro did not attempt to guard some strong passes, through which Pizarro had to march, but waited patiently for his adversary in a plain open country.

30
Almagro defeated and taken prisoner,

In the mean time, Pizarro advanced without any obstruction from his enemy; and an engagement soon happened, in which Almagro was defeated and taken prisoner. The conquerors behaved with great cruelty, massacring a great number of officers, and treating Almagro himself with great severity. The Indians had assembled in great numbers to see the battle, with an intention to join the vanquished party; but were so much overawed by the Spaniards, that they retired quietly after the battle was over, and thus lost the only opportunity they ever had of expelling their tyrants.—Almagro, after having for some months languished in prison, was at length formally tried, and condemned to die by Pizarro. Notwithstanding his consummate bravery, for which he was remarkable, this hardy veteran could not bear the deliberate approach of death, but condescended to use intreaties to save his life. The Pizarros, however, continued inflexible; and he was first strangled in prison, and then publicly beheaded. He left one son by an Indian woman, whom he appointed his successor, by virtue of a power granted him by the emperor.

31
and strangled.

As during these dissensions all intercourse with Spain ceased, it was some time before the accounts of the civil war were received at court. The first intelligence was given by some of Almagro's soldiers, who had left America on the ruin of their cause; and they did not fail to represent the injustice and violence of Pizarro in the strongest colours, which strongly prejudiced the emperor against him. In a short time, however, Ferdinand Pizarro arrived, and endeavoured to give matters a new turn. The emperor was uncertain which of them he ought to believe; and therefore thought it necessary to send over some person with ample powers to inquire into the merits of the cause, and to determine certainly who was in the wrong. If he found the governor still alive, he was to assume only the title of judge, in order to have the appearance of acting in concert with him; but if he was dead, the viceroy might then produce his commission appointing him Pizarro's successor in the government. This complaisance to Pizarro, however, proceeded more from a dread of his power than from any other thing; for in the mean time, his brother Ferdinand was arrested at Madrid, and confined to a prison where he remained above 20 years. The person nominated to this important trust was Christoval Vaca de Castro.

32
Peru divided by Pizarro among his associates.

While this gentleman was preparing for his voyage, Pizarro considering himself as the unrivalled master of Peru, proceeded to parcel out his territories among the conquerors; and had this division been made with any degree of impartiality, the extent of country which he had to bestow was sufficient to have gratified his friends, and to have gained his enemies. But Pizarro conducted this transaction, not with the equity and candour of a judge attentive to discover and to reward merit, but with the illiberal spirit of a party-leader. Large districts, in parts of the country most cultivated and populous, were set apart as his own property, or granted to his brothers, his adherents, and favourites. To others, lots less valuable and inviting were assigned. The followers of Almagro, amongst whom were many of the original adventurers, to whose valour and perseverance Pizarro was indebted for his success, were totally excluded from any portion in those lands, towards the acquisition of which they had contributed so largely. As the vanity of every individual sets an immoderate value upon his own services, and the idea of each, concerning the recompense due to them, rose gradually to a more exorbitant height in proportion as their conquests extended, all who were disappointed in their expectations exclaimed loudly against the rapaciousness and partiality of the governor. The partisans of Almagro murmured in secret, and meditated revenge.

Rapid as the progress of the Spaniards in South America had been since Pizarro landed in Peru, their avidity of dominion was not yet satisfied. The officers to whom Ferdinand Pizarro gave the command of different detachments, penetrated into several new provinces; and though some of them were exposed to great hardships in the cold and barren regions of the Andes, and others suffered distress not inferior amidst the woods and marshes of the plains, they made discoveries and conquests which extended their knowledge of the country, as well as added to their power. Pedro de Valdivia re assumed Almagro's scheme of invading Chili; and, notwithstanding the fortitude of the natives in defending their possessions, made such progress in the conquest of the country, that he founded the city of St Jago, and gave a beginning to the establishment of the Spanish dominion there. But of all the enterprises undertaken about this period, that of Gonzales Pizarro was the most remarkable. The governor, who seems to have resolved that no person in Peru should possess any station of distinguished eminence or authority but those of his own family, had deprived Benalcazar, the conqueror of Quito, of his command in that kingdom, and appointed his brother Gonzales to take the government of it. He instructed him to attempt the discovery and conquest of the country to the east of the Andes; which, according to the information of the Indians, abounded with cinnamon and other valuable spices. Gonzales, not inferior to any of his brothers in courage, and no less ambitious of acquiring distinction, eagerly engaged in this difficult service. He set out from Quito at the head of 340 soldiers, near one half of whom were horsemen, with 4000 Indians to carry their provisions. In forcing their way through the defiles, or over the ridges of the Andes, excess of cold and fatigue, to neither of which they were accustomed, proved fatal to the greater part of the wretched attendants. The Spaniards, though more robust, and inured to a variety of climates, suffered considerably, and lost some men; but when they descended into the low country, their distress increased. During two months it rained incessantly, without any interval of fair weather long enough to dry their clothes. The vast plains upon which they were now entering, either altogether without inhabitants, or occupied by the rudest and least industrious tribes of the New World, yielded little subsistence. They could not advance a step but as they cut a road through woods, or made it through marshes. Such incessant toil and continual scarcity of food, seem more than sufficient to have exhausted and dispirited any troops. But the fortitude and perseverance of the Spaniards in the 16th century were insuperable. Allured by frequent but false accounts of rich countries before them, they persisted in struggling on, until they reached the banks of the Coca or Napo, one of the large rivers whose waters pour into the Maragnon, and contribute to its grandeur. There, with infinite labour, they built a bark, which they expected would prove of great utility, both in conveying them over rivers, in procuring provisions, and in exploring the country. This was manned with 50 soldiers, under the command of Francis Orellana, the officer next in rank to Pizarro. The stream carried them down with such rapidity, that they were soon far a-head of their countrymen, who followed slowly and with difficulty by land.

Orella sails the Mara non, a deserts Pizarr

At this distance from his commander, Orellana, a young man of an aspiring mind, began to fancy himself independent; and, transported with the predominant passion of the age, he formed the scheme of distinguishing himself as a discoverer, by following the course of the Maragnon until it joined the ocean, and by surveying the vast regions through which it flows. This scheme of Orellana's was as bold as it was treacherous. For, if he be chargeable with the guilt of having violated his duty to his commander, and with having abandoned his fellow-soldiers in a pathless desert, where they had hardly any hopes of success or even of safety, but what were founded on the service which they expected from the bark, his crime is, in some measure, balanced by the glory of having ventured upon a navigation of near 2000 leagues, through unknown nations, in a vessel hastily constructed with green timber, and by very unskilful hands, without provisions, without a compass, or a pilot. But his courage and alacrity supplied every defect. Committing himself fearlessly to the guidance of the stream, the Napo bore him along to the south, until he reached the great channel of the Maragnon. Turning with it towards the coast, he held on his course in that direction. He made frequent descents on both sides the river, sometimes seizing by force of arms the provisions of the fierce savages seated on its banks, and sometimes procuring a supply of food by a friendly intercourse with more gentle tribes. After a long series of dangers, which he encountered with amazing fortitude, and of distresses which he supported with no less magnanimity, he reached the ocean, where new perils awaited him. These he likewise surmounted, and got safe to the

33
Expedition of Gonzales Pizarro.

the Spanish settlement in the island of Cubagua; from thence he sailed to Spain. The vanity natural to travellers who visit regions unknown to the rest of mankind, and the art of an adventurer, solicitous to magnify his own merit, concurred in prompting him to mingle an extraordinary proportion of the marvellous in the narrative of his voyage. He pretended to have discovered nations so rich, that the roofs of their temples were covered with plates of gold; and described a republic of women so warlike and powerful, as to have extended their dominion over a considerable tract of the fertile plains which he had visited. Extravagant as those tales were, they gave rise to an opinion, that a region abounding with gold, distinguished by the name of *El Dorado*, and a community of Amazons, were to be found in this part of the New World; and such is the propensity of mankind to believe what is wonderful, that it has been slowly, and with difficulty, that reason and observation have exploded those fables. The voyage, however, even when stripped of every romantic embellishment, deserves to be recorded, not only as one of the most memorable occurrences in that adventurous age, but as the first event that led to any certain knowledge of those immense regions that stretch eastward from the Andes to the ocean.

35
Extreme distress of Gonzales Pizarro and his men.

No words can describe the consternation of Pizarro, when he did not find the bark at the confluence of the Napo and Maragnon, where he had ordered Orellana to wait for him. He would not allow himself to suspect that a man, whom he had entrusted with such an important command, could be so base and so unfeeling as to desert him at such a juncture. But imputing his absence from the place of rendezvous to some unknown accident, he advanced above 50 leagues along the banks of the Maragnon, expecting every moment to see the bark appear with a supply of provisions. At length he came up with an officer whom Orellana had left to perish in the desert, because he had the courage to remonstrate against his perfidy. From him he learned the extent of Orellana's crime; and his followers perceived at once their own desperate situation, when deprived of their only resource. The spirit of the stoutest hearted veteran sunk within him; and all demanded to be led back instantly. Pizarro, though he assumed an appearance of tranquillity, did not oppose their inclination. But he was now 1200 miles from Quito; and in that long march the Spaniards encountered hardships greater than those they had endured in their progress outward, without the alluring hopes which then soothed and animated them under their sufferings. Hunger compelled them to feed on roots and berries, to eat all their dogs and horses, to devour the most loathsome reptiles, and even to gnaw the leather of their saddles and sword belts. Four thousand Indians, and 210 Spaniards, perished in this wild and disastrous expedition, which continued near two years: and as 50 men were aboard the bark with Orellana, only 80 got back to Quito. These were naked like savages, and so emaciated with famine, or worn out with fatigue, that they had more the appearance of spectres than of men.

36
A conspiracy formed against the governor;

But, instead of returning to enjoy the repose which his condition required, Pizarro, on entering Quito, received accounts of a fatal event that threatened calamities more dreadful to him than those through which he had passed. From the time that his brother made the partial division of his conquests which has been mentioned, the adherents of Almagro, considering themselves as proscribed by the party in power, no longer entertained any hope of bettering their condition. Great numbers in despair resorted to Lima, where the house of young Almagro was always open to them: and the slender portion of his father's fortune, which the governor allowed him to enjoy, was spent in affording them subsistence. The warm attachment with which every person who served under the elder Almagro devoted himself to his interests, was quickly transferred to his son, who was now grown up to the age of manhood, and possessed all the qualities which captivate the affections of soldiers. Of a graceful appearance, dexterous at all martial exercises, bold, open, generous, he seemed to be formed for command; and as his father, conscious of his own inferiority from the total want of education, had been extremely attentive to have him instructed in every science becoming a gentleman, the accomplishments which he had acquired heightened the respect of his followers, as they gave him distinction and eminence among illiterate adventurers. In this young man the Almagrians found a point of union which they wanted; and looking up to him as their head, were ready to undertake any thing for his advancement. Nor was affection for Almagro their only incitement; they were urged on by their own distresses. Many of them, destitute of common necessaries, and weary of loitering away life, a burden to their chief, or to such of their associates as had saved some remnant of their fortune from pillage and confiscation, longed impatiently for an occasion to exert their activity and courage, and began to deliberate how they might be avenged on the author of all their misery. Their frequent cabals did not pass unobserved; and the governor was warned to be on his guard against men who meditated some desperate deed, and had resolution to execute it. But, either from the native intrepidity of his mind, or from contempt of persons whose poverty rendered their machinations of little consequence, he disregarded the admonitions of his friends. "Be in no pain (said he carelessly) about my life; it is perfectly safe, as long as every man in Peru knows that I can in a moment put him to death who dares to harbour a thought against it." This security gave the Almagrians full leisure to digest and ripen every part of their scheme; and Juan de Herrada, an officer of great abilities, who had the charge of Almagro's education, took the lead in their consultations, with all the zeal which that connection inspired, and with all the authority which the ascendant that he was known to have over the mind of his pupil gave him.

37
who is murdered.

On Sunday, the 26th of June, at midday, the season of tranquillity and repose in all sultry climates, Herrada, at the head of 18 of the most determined conspirators sallied out of Almagro's house in complete armour; and drawing their swords, as they advanced hastily towards the governor's palace, cried out, "Long live the king, but let the tyrant die." Their associates, warned of their motions by a signal, were in arms at different stations ready to support them. Though Pizarro was usually surrounded by such a numerous train of attendants as suited the magnificence of the most opulent subject of the age in which he lived, yet as he was just risen from table, and most of his own domestics had retired to their own apartments, the conspirators passed through the two outer courts of the palace unobserved. They were at the bottom of the staircase, before a page in waiting could give the alarm to his master, who was conversing with a few friends in a large hall. The governor, whose steady mind no form of danger could appal, starting up, called for arms, and commanded Francisco de Chaves to make fast the door. But that officer, who did not retain so much presence of mind as to obey this prudent order, running to the top of the staircase, wildly asked the conspirators what they meant, and whither they were going? Instead of answering, they stabbed him to the heart, and burst into the hall. Some of the persons who were there threw themselves from the windows; others attempted to fly; and a few drawing their swords, followed their leader into an inner apartment. The conspirators, animated with having the object of their vengeance now in view, rushed forward after them. Pizarro, with no other arms than his sword and buckler, defended the entry, and, supported by his half-brother Alcantara and his little knot of friends, maintained the unequal contest with intrepidity worthy of his past exploits, and with the vigour of a youthful combatant. "Courage (cried he) companions, we are yet enow to make those traitors repent of their audacity." But the armour of the conspirators protected them, while every thrust they made took effect. Alcantara fell dead at his brother's feet; his other defendants were mortally wounded. The governor, so weary that he could hardly wield his sword, and no longer able to parry the many weapons furiously aimed at him, received a deadly thrust full in his throat, sunk to the ground, and expired.

As soon as he was slain, the assassins ran out into the streets, and waving their bloody swords, proclaimed the death of the tyrant. Above 200 of their associates having joined them, they conducted young Almagro in solemn procession through the city; and assembling the magistrates and principal citizens, compelled them to acknowledge him as lawful successor to his father in his government. The palace of Pizarro, together with the houses of several of his adherents, were pillaged by the soldiers; who had the satisfaction at once of being avenged on their enemies, and of enriching themselves by the spoils of those through whose hands all the wealth of Peru had passed.

38 Young Almagro heads the rebels.

The new governor marched into the heart of the empire, in order to reduce such places as refused to acknowledge his authority. A multitude of ruffians joined him on his march. His army breathed nothing but vengeance and plunder: every thing gave way before it. If the military talents of the general had equalled the ardour of his troops, the war had ended here. Unhappily for Almagro, he had lost his conductor John de Herrada. His inexperience made him fall into the snares that were laid for him by Pedro Alvares, who had put himself at the head of the opposite party. He lost, in attempting to unravel his plots, that time that he ought to have employed in fighting. In these circumstances, an event, which no one could have foreseen, happened to change the face of affairs.

The licentiate Vaca di Castro, who had been sent from Europe to try the murderers of old Almagro, arrived at Peru. As he was appointed to assume the government in case Pizarro was no more, all who had not sold themselves to the tyrant hastened to acknowledge him. Uncertainty and jealousy, which had for too long a time kept them dispersed, were no longer an obstacle to their re-union. Castro, who was as resolute as if he had grown old in the service, did not suffer their impatience to languish, but instantly led them against the enemy. The two armies engaged at Chapas on the 16th of September 1542, and fought with inexpressible obstinacy. Victory, after having wavered a long time, at the close of the day decided in favour of that party whose cause was the most just. Those among the rebels who were most guilty, dreading to languish under disgraceful tortures, provoked the conquerors to murder them, crying out, like men in despair, *It was I who killed Pizarro.* Their chief was taken prisoner, and died on the scaffold.

39 He is defeated by Vaca di Castro.

While these scenes of horror were transacting in America, the Spaniards in Europe were employed in finding out expedients to terminate them; though no measures had been taken to prevent them. Peru had only been made subject to the audience of Panama, which was too remote to superintend the maintenance of good order, and had too little influence to make its decrees respected. A supreme tribunal was then established at Lima for the dispensation of justice, which was to be invested with authority sufficient to enforce and to reward a due obedience to the laws. Blasco Nunez Vela, who presided in it as viceroy, arrived in 1544, attended by his subordinates in office, and found every thing in the most dreadful disorder.

To put an end to those tumults which now subsisted, would have required a profound genius, and many other qualities which are seldom united. Nunez had none of these advantages. Nature had only given him probity, firmness, and ardour; and he had taken no pains to improve these gifts. With these virtues which were almost defects in his situation, he began to fulfil his commission, without regard to places, persons, or circumstances.

40 Bad conduct of the viceroy Nunez Vela.

Contrary to the opinion of all intelligent persons, who wished that he should wait for fresh instructions from Europe, he published ordinances, which declared that the lands the conquerors had seized should not pass to their descendants, and which dispossessed those who had taken part in the civil commotions. All the Peruvians who had been enslaved by monks, bishops, and persons belonging to the government, were declared free. Those who belonged to other masters were to be freed from their shackles at the death of their oppressors. They could no longer be compelled to bury themselves in the mines, nor could any kind of labour be exacted from them without payment. Their tribute was fixed. The Spaniards who travelled on foot were deprived of the right of taking three Indians to carry their baggage; and those who travelled on horseback, of the right of taking five. The caciques were discharged from the obligation of furnishing the traveller and his retinue with provisions gratis. Other tyrannical establishments also would soon have been proscribed; and the conquered people were on the eve of being sheltered under the protection of laws, which would at least have tempered the rigours of the right of conquest, if even they had not entirely repaired the injustice of them; but it should seem that the Spanish government was only to be unfortunate in the good it attempted to effect.

A change so unexpected filled those with consternation who saw their fortunes wrested from them, or who lost the flattering hope of transmitting them to their posterity. Even those who were not affected by these interested views, being accustomed to look upon the Indians as the instruments and victims of their avarice, had no conception that any other ideas could prevail concerning them. From astonishment they proceeded to indignation, murmuring, and sedition. The viceroy was degraded, put in irons, and banished to a desert island, till he could be conveyed to Spain.

Gonzales Pizarro was then returned from his hazardous expedition, which had employed him long enough to prevent him from taking a part in those revolutions which had so rapidly succeeded each other. The anarchy he found prevailing at his return, inspired him with the idea of seizing the supreme authority. His fame and his forces made it impossible that this should be refused him; but his usurpation was marked with so many enormities, that Nunez was regretted. He was recalled from exile, and soon collected a sufficient number of forces to enable him to take the field. Civil commotions were then renewed with extreme fury by both parties. No quarter was asked or given on either side. The Indians took part in this as they had done in the preceding wars; some ranged themselves under the standard of the viceroy, others under the banners of Gonzales. From 15,000 to 20,000 of these unhappy wretches, who were scattered about in each army, dragged up the artillery, levelled the roads, carried the baggage, and destroyed one another. Their conquerors had taught them to be sanguinary. After a variety of advantages for a long time alternately obtained, fortune at length favoured the rebellion under the walls of Quito in the month of January, in the year 1545; and Nunez with the greatest part of his men were massacred.

41
He is overcome and killed by Gonzales Pizarro.

Pizarro took the road of Lima, where they were deliberating on the ceremonies with which they should receive him. Some officers wished that a canopy should be carried for him to march under, after the manner of kings. Others, with adulation still more extravagant, pretended that part of the walls of the town, and even some houses must be pulled down; as was the custom at Rome, when the generals obtained the honours of a triumph. Gonzales contented himself with making his entrance on horseback, preceded by his lieutenant, who marched on foot. Four bishops accompanied him, and he was followed by the magistrates. The streets were strewn with flowers, and the air resounded with the noise of bells and various musical instruments. This homage totally turned the head of a man naturally haughty, and of confined ideas. He spoke and acted in the most despotic manner.

Had Gonzales possessed judgment and the appearance of moderation, it would have been possible for him to render himself independent. The principal persons of his party wished it. The majority would have beheld this event with indifference, and the rest would have been obliged to consent to it. Blind cruelties, insatiable avarice, and unbounded pride, altered these dispositions. Even those, whose interests were connected with those of the tyrant, wished for a deliverer.

42
An end put to the troubles by Pedro di la Gasca.

Such a deliverer arrived from Europe in the person of the licentiate Pedro di la Gasca. The squadron and the provinces of the mountains immediately declared for a person who was invested with a lawful authority to govern them. Those who lived concealed in deserts, caverns, and forests, quitted their retreats to join him. Gonzales, who saw no resource left to support him but in some great achievement, took the road of Cuzco, with a resolution to give battle. At some leagues distance from this place he met the royal army, and attacked it on the 9th of June 1548. One of his lieutenants, seeing him abandoned at the first charge by his best soldiers, advised him to throw himself into the enemy's battalions, and perish like a Roman: but this weak man chose rather to surrender, and end his life on a scaffold. Carvajal, a more able warrior, and more ferocious than himself, was quartered. This man, when he was expiring, boasted that he had massacred with his own hand 1400 Spaniards and 20,000 Indians.

Such was the last scene of a tragedy, of which every act has been marked with blood. The government was moderate enough not to continue the proscriptions; and the remembrance of the horrid calamities they had suffered kept the Spaniards in the bounds of subjection. What still remained of that commotion that had been raised in their minds, insensibly sunk into a calm; and the country hath remained in quiet ever since.

43
Hard fate of the Peruvians.

With regard to the Peruvians, the most cruel measures were taken to render it impossible for them to rebel. Tupac Amaru, the heir of their last king, had taken refuge in some remote mountains, where he lived in peace. There he was so closely surrounded by the troops which had been sent out against him, that he was forced to surrender. The viceroy Francis de Toledo caused him to be accused of several crimes that he had not committed, and for which he was beheaded in 1571. All the other descendants of the Incas shared the same fate, under pretence that they had conspired against their conquerors. The horror of these enormities excited so universal an indignation both in the Old and the New World, that Philip II. thought himself obliged to disavow them; but the infamous policy of this prince was so notorious, that no credit was given to this appearance of his justice and humanity.

44
Extent of the empire.

The empire of Peru, at the time it was subdued, extended along the South sea, from the river of Emeralds to Chili, and on the land side to Popayan, according to some geographers. It contained within its extent that famous chain of mountains which rises in the Terra Magellanica, and is gradually lost in Mexico, in order to unite, as it should seem, the southern parts of America with the northern.

Payne's Geography.

It was subsequently divided into three grand divisions or audiences; Quito, Lima or Los Reyes, and Los Charcos. As to its climate, mines, soil, and produce, they differ greatly in different parts of this country.

45
Province of Quito.

The extensive province of Quito is bounded on the north by Popayan, and includes a part of that government, also by Santa Fe de Bogota; and on the south by the government of Piura and Chachapoyas; on the east it extends over the whole government of Maynas and the river of the Amazons to the meridian, which divides the Spanish from the Portuguese dominions; and on the west it is bounded by the South sea, extending, according to Antonio de Ulloa, 600 leagues in length, and about 200 in its greatest breadth; but this greatly exceeds the computation of all other geographers. He however observes, that it must be owned a great part of those vast dominions are either inhabited by nations of Indians, or have not hitherto been sufficiently peopled by the Spaniards, if indeed they have been thoroughly known; and that all the parts that can properly be said to be peopled, and actually subject to the Spanish government, are those intercepted by the two Cordilleras of the Andes, which, in comparison to the extent of the country, may be termed a street or lane, 15 leagues, or sometimes more, from east to west; to this must be added several detached governments, separated by the very extensive tracts inhabited by free Indians.

46
Climate, seasons, &c. of this province.

The climate of Quito differs from all others in the same parallel, since even in the centre of the torrid zone, or although under the equinoctial, the heat is not only very tolerable, but even in some places the cold is painful; while others enjoy all the advantages of a perpetual spring, the fields being constantly covered with verdure, and enamelled with flowers of the most lively colours. The mildness of the climate, free from the extremes of heat and cold, and the constant equality of the day and night, render this country, which from its situation might be thought to be parched by the constant heat of the sun, and scarcely inhabitable, both pleasant and fertile; for nature has here dispensed her blessings with so liberal a hand, that this country in several respects surpasses those of the temperates zones, where the vicissitudes of winter and summer, and the change from heat to cold, cause the extremes of both to be more sensibly felt. However, in different parts of the country, the air is very different; in one part are mountains of a stupendous height and magnitude, with their summits covered with snow. The plains are temperate, the valleys hot, and, according to the high or low situations of the country, are found all the variety of gradations in temperature possible to be conceived between the extremes of heat and cold.

Quito, the capital, in 13′ south latitude, and 77° 50′ west longitude from Greenwich, is so happily situated, that neither heat nor cold are troublesome, though both may be felt in its neighbourhood; and what renders this equality more delightful is, that it is constant throughout the whole year, the difference between the seasons being scarce perceptible. Indeed the mornings are cool, the remainder of the day warm, and the nights of an agreeable temperature. See QUITO.

The winds, which are pure and salubrious, blow for the most part from north to south, but never with any violence, though they sometimes shift their quarters, but without any regard to the season of the year. Such signal advantages resulting from the climate, soil, and aspect of this country, would be sufficient to render it the most enviable spot upon earth, as it is supposed to be the most elevated, if, whilst enjoying these delights, the inhabitants were not harassed by terror, and exposed to continual danger; for here tremendous tempests of thunder and lightning prevail, which are sufficient to appal the stoutest heart; whilst earthquakes frequently spread universal apprehensions, and sometimes bury cities in ruins.

The distinction of winter and summer consists in a very minute difference; the interval between the month of September and those of April, May, or June, is here called the winter season, and the other months compose the summer. In the former season the rain chiefly prevails, and in the latter the inhabitants frequently enjoy whole days of fine weather; but whenever the rains are discontinued for above a fortnight, the inhabitants are in the utmost consternation, and public prayers are offered up for their return. On the other hand, when they continue a short time without intermission, the like fears prevail, and the churches are again crowded with supplicants to obtain fine weather; for a long drought produces dangerous diseases, and a continual rain, without intervals of sunshine, destroys the fruits of the earth. The city of Quito, however, enjoys one peculiar advantage, in being free from musketoes and other troublesome insects, such as fleas and venomous reptiles, except the *nigua* or *pique*, which is a very small insect shaped like a flea, but hardly visible to the sight.

47
Soil, produce, &c.

Though there is much barren land in the country, the fertility of the soil in some spots is incredible, for the fruits and beauties of the several seasons are visible at the same time; and the curious European observes with a pleasing admiration, that while some herbs of the field are fading, others of the same kind are springing up; while some flowers lose their beauty, others blow to continue the enamelled prospect: thus, when the fruits of the trees have attained their maturity, and the leaves begin to change their colour, fresh leaves blossom, and fruits are seen in their proper gradations in size and ripeness on the same tree. The same incessant fertility is conspicuous in the corn, both reaping and sowing being carried on at the same time: so that the declivities of the neighbouring hills exhibit all the beauties of the four seasons in one assemblage. Though all this is generally seen, yet there is a settled time for the grand harvest: yet sometimes the most favourable season for sowing in one place is a month or two after that of another, though their distance does not exceed three or four leagues. Thus in different spots, and sometimes in one and the same, sowing and reaping are performed throughout the whole year, the forwardness or retardment naturally arising from the different situations, such as mountains, rising grounds, plains, and valleys; and the temperature being different in each, the best times for performing the several operations of husbandry must also differ.

The *chirimoya* is considered as one of the most delicious fruits in the world. Its dimensions are various, being from one to five inches in diameter. Its figure is imperfectly round, flatted towards the stalk, where it forms a kind of navel; but all the other parts are nearly circular. It is covered with a thin soft shell, which adheres so closely to the pulp as not to be separated from it without a knife. The outward coat is green, variegated with prominent veins, forming all over it a kind of net-work. The pulp is white, and contains a large quantity of juice resembling honey, of a sweet taste, mixed with a gentle acid of a most exquisite flavour. The seeds are formed in several parts of the pulp, and are somewhat flat. The tree is high and tufted, the stem large and round, but with some inequalities,

qualities, full of elliptic leaves, terminating in a point. The blossom differs little from the colour of the leaves, which is a darkish green; and though far from being beautiful, is remarkable for its incomparable fragrance.

The *granadilla* in its shape resembles an hen's egg, but is larger. The outside of the shell is smooth, glossy, and of a faint carnation colour, and the inside white and soft. The shell contains a viscous liquid substance, full of very small and delicate grains, less hard than those of the pomegranate. This medullary substance is separated from the shell by a fine and transparent membrane. Its fruit has a delightful sweetness blended with acidity, very cordial and refreshing, and so wholesome, that there is no danger of eating to excess.

The *frutilla*, or Peruvian strawberry, is very different from that of Europe in size; though they are here generally not above an inch in length, they are much larger in other parts of Peru; but their taste, though juicy, and not unpalatable, is not equal to those in Europe.

48
Inhabitants.

The country is observed to abound more in women than in men, which is the more remarkable, as those causes which induce men to leave their country, as travelling, commerce, and war, naturally bring over more men from Europe than women. But there are many families in which there are a number of daughters, without one son among them. The women enjoy a better state of health than the men, which may be owing in some measure to the climate, and more particularly to the early intemperance and voluptuousness of the other sex.

The Creoles are well made, of a proper stature, and of a lively and agreeable countenance. The Mestizos are also in general well made, often taller than the ordinary size, very robust, and have an agreeable air. The Indians, both men and women, are commonly low of stature, though strong and well proportioned; but more natural defects are to be found among them than in any of the rest. Some are remarkably short, some idiots, dumb, or blind. Their hair is generally thick and long, which they wear loose on their shoulders; but the Indian women plait theirs behind with a ribbon, and cut that before a little above the eyebrows, from one ear to the other. The greatest disgrace that can be offered to an Indian of either sex is to cut off their hair; for whatever corporal punishment their masters think proper to inflict on them, they bear with patience; but this affront they never forgive; and accordingly the government has interposed, and limited this punishment to the most enormous crimes. The colour of the hair is generally a deep black: it is lank, harsh, and as coarse as that of a horse. On the contrary, the male Mestizos, in order to distinguish themselves from the Indians, cut off their hair; but the females do not adopt that custom.

49
Their dress.

The Mestizos in general wear a blue cloth, manufactured in this country; but though they are the lowest class of Spaniards, they are very ambitious of distinguishing themselves as such, either by the colour or fashion of the clothes they wear.

The Mestizo women affect to dress in the same manner as the Spanish, though they cannot equal the ladies in the richness of their stuffs. The meaner sort wear no shoes; but, like the men of the same rank, go barefooted.

The dress of the Indians consists of white cotton drawers, which hang down to the calf of the leg, where they are loose, and edged with a lace suitable to the stuff. The use of a shirt is supplied by a black cotton frock, made in the form of a sack, with three openings at the top, one in the middle for the head, and others at the corners for the arms; thus covering their naked bodies down to the knees. Over this is a serge cloak, with a hole in the middle for putting the head through, and a hat made by the natives. This is their general dress, which they never lay aside, even while they sleep; and they have no additional clothing for their legs or feet. The Indians, who have acquired some fortune, particularly the barbers and phlebotomists, distinguish themselves from their countrymen by the fineness of their drawers, and by wearing a shirt, which, though without sleeves, has a lace four or five fingers in breadth, fastened round like a kind of ruff or band. They are fond of silver or gold buckles to their shoes, though they wear no stockings; and instead of a mean serge cloak, wear one of fine cloth, which is often adorned with gold or silver lace.

There are two kinds of dresses worn by the Indian women, made in the same plain manner with those worn by the men in general, the whole consisting of a short petticoat and a veil of American baize. But the dress of the lowest class of Indian women is only a bag of the same make and stuff as that of the men, which they fasten on their shoulders with two large pins: it reaches down to the calf of the leg, and is fastened round the waist with a kind of girdle. Instead of a veil, they wear about the neck a piece of the same coarse stuff dyed black; but their arms and legs are naked.

50
Food and drink, &c.

The people have dishes unknown in Europe; but are particularly fond of cheese; and have excellent butter in the neighbourhood of Quito. Sweetmeats are very much admired.

Rum is commonly drank here by persons of all ranks, but their favourite liquor is brandy. The disorders arising from the excessive use of spirituous liquors are chiefly seen among the Mestizos; and the lower class of women, both among the Creoles and Mestizos, are also extremely addicted to the same species of debauchery.

Another liquor much used in this country is mate, which is made of an herb known in all these parts of America by the name of Paraguay, as being the produce of that country. Some of it is put into a calabash tipped with silver, called here *mate*, with sugar and some cold water. After it has continued there some time, the calabash is filled with boiling water, and they drink the liquor through a pipe fixed in the calabash. It is also usual to squeeze into the liquor a small quantity of the juice of lemons or Seville oranges, mixed with some perfumes from odoriferous flowers. This is their usual drink in the morning fasting, and many use it also at their evening regale. The manner of drinking it appears very indelicate, the whole company taking it successively through the same pipe, it being carried several times round the company till all are satisfied. This among the Creoles is the highest enjoyment: so that when they travel, they never fail to carry with them a sufficient quantity of it, and till they have taken their dose of mate they never eat.

The vice of gaming is here carried to an extravagant height, to the ruin of many families, some losing their stocks in trade, others the very clothes from their backs, and afterwards those belonging to their wives, which they hazard, stimulated by the hope of recovering their own.

The common people, the Indians, and even the domestics, are greatly addicted to stealing. The Mestizos, though arrant cowards, do not want audacity in this way; for though they will not venture to attack any one in the street, it is a common practice to snatch off a person's hat, and immediately seek their safety in flight. This acquisition is sometimes of considerable value; the hats worn by persons of rank, and even by the wealthy citizens when dressed, being of white beaver, worth fifteen dollars, besides the hatband of gold or silver lace, fastened with a gold buckle set with diamonds or emeralds. Robberies on the highway are seldom heard of.

51
Language.

In most of the towns and villages, different dialects are spoken, Spanish being no less common than the Inga, the language of the country. The Creoles use the latter as much as the former, but both are considerably adulterated by borrowed words and expressions. The first language generally spoken by children is the Inga; for the nurses being Indians, many of them do not understand a word of Spanish, and thus they afterward learn a jargon composed of both languages.

52
Honour paid the dead.

The sumptuous manner of performing the last offices for the dead, demonstrates how far the power of habit is capable of prevailing over reason and prudence, for their ostentation is so great in this particular, that many families of credit are ruined by preposterously endeavouring to excel others; and the people here may be said to toil and scheme to lay up wealth, to enable their successors to lavish honours upon a body insensible of all pageantry.

53
Commerce.

The commerce of the province of Quito is chiefly carried on by Europeans settled here, and others who occasionally arrive. The manufactures of this province are only cottons, some white and stripped baize, and cloths, which meet with a good market at Lima, for supplying the inward provinces of Peru. The returns are made partly in silver, and partly in fringes made of gold and silver thread, and wine, brandy, oil, copper, tin, lead, and quicksilver. On the arrival of the galleons at Carthagena, these traders resort thither to purchase European goods, which, at their return, they consign to their correspondents all over the province. The coasts of New Spain supply this province with indigo, of which there is a very large consumption at the manufactures, blue being universally the colour which this people adopt for their apparel. They also import, by way of Guayaquila, iron and steel both from Europe and the coast of Guatemala.

54
Disposition of the inhabitants.

The disposition of the Indians in the province of Quito is extremely remarkable, and they appear to have no resemblance to the people found there by those who first discovered the country. They at present possess a tranquillity not to be disturbed either by fortunate or unfortunate events. In their mean apparel they are as contented as a prince clothed in the most splendid robes. They show the same disregard to riches; and even the authority and grandeur within their reach is so little the object of their ambition, that to all appearance it seems to be the same to an Indian whether he be created an alcalde, or obliged to perform the office of a common executioner.

Their sloth is so great that scarcely any thing can induce them to work. Whatever therefore is necessary to be done is left to the Indian women, who are much more active; they spin and make the half shirts and drawers which form the only apparel of their husbands; they cook the provisions, grind barley, and brew the beer called *chicha*; while the husband sits squatting on his hams, the usual posture of the Indians, looking at his busy wife. The only domestic service they do is to plough their little spot of land, which is sowed by the wife. When they are once seated on their hams, no reward can induce them to stir; so that if a traveller has lost his way, and happens to come to one of their cottages, they charge their wives to say that they are not at home. Should the passenger alight and enter the cottage, the Indian would still be safe; for having no light but what comes through a hole in the door, he could not be discovered; and should the stranger even see the Indian, neither entreaties nor rewards would prevail on him to stir a step with him.

They are lively only in parties of pleasure, rejoicings, entertainments, and especially dancing; but in all these the liquor must circulate briskly, and they continue drinking till they are entirely deprived both of sense and motion.

It is remarkable that the Indian women, whether maids or married, and Indian young men before they are of an age to contract matrimony, are never guilty of this vice: it being a maxim among them, that drunkenness is the privilege of none but masters of families, who, when they are unable to take care of themselves, have others to take care of them.

The women present the chicha (A) to their husbands in calabashes, till their spirits are raised; then one plays on a pipe and tabor, while others dance. Some of the best voices among the Indian women sing songs in their own language, and those who do not dance, squat down in the usual posture till it comes to their turn. When tired with intemperance, they all lie down together, without regarding whether they be near the wife of another or their own sister or daughter. These festivities sometimes continue three or four days, till the priest coming

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(A) This is a liquor made from maize by the following process. The maize, after being soaked in water till it begin to grow, is dried in the sun, then parched a little, and at last ground. The flour, after it has been well kneaded, is put with water into a large vessel, and left two or three days to ferment. Its taste is nearly that of the most indifferent kind of cyder. It is a refreshing, nourishing, and aperitive liquor; but it will not keep above eight days without turning sour.

coming among them, throws away all the chicha, and disperses the Indians, lest they should procure more.

Their funerals are likewise solemnized with excessive drinking. The house is filled with jugs of chicha, for the solace of the mourners and other visitors; the latter even go out into the streets, and invite all of their nation who happen to pass by to come in and drink to the honour of the deceased. This ceremony lasts four or five days, and sometimes more, strong liquor being their supreme enjoyment.

55 Their manner of contracting marriages.

The Indians in the audience of Quito are said to act contrary to all other nations in their marriages; for they never make choice of a woman who has not been first enjoyed by others, which they consider as a certain indication of her personal attractions. After a young man has made choice of a woman, he asks her of her father, and having obtained his consent, they begin to cohabit together as man and wife, and assist the father-in-law in cultivating the land. At the end of three or four months, and frequently of a year, the husband leaves his bride or wife without any ceremony; and perhaps expostulates with his father-in-law for endeavouring to deceive him, by imposing upon him his daughter, whom nobody else had thought worthy of making a bedfellow. But if no disgust arises in the man on this account or any other, after passing three or four months in this commerce, which they call *amanarse*, or to habituate one's self, they then marry. This custom is still very common, though the whole body of the clergy have used all their endeavours to put a stop to it. Accordingly they always absolve them of that sin before they give them the nuptial benediction.

56 Appearance of the country in this province.

It has been observed, that the dependencies of the jurisdictions of Quito are seated between the two Cordilleras of the Andes, and that the air is more or less cold, and the ground more or less sterile, according to the height of the mountains. These barren tracts are called deserts: for though all the Cordilleras are dry, some are much more so than others; and the continual snow and frosts render some parts of them incapable of producing a single plant, and consequently they are uninhabitable by man or beast.

Some of these mountains, which appear to have their bases resting on other mountains, rise to a most astonishing height, and, reaching far above the clouds, are here, although in the midst of the torrid zone, covered with perpetual snow. From experiments made with a barometer on the mountain of Cotopaxi, it appeared that its summit was elevated 6252 yards above the surface of the sea, something above three geographical miles, which greatly exceeds the height of any other volcanic mountain in the known world.

Cotopaxi became a volcano about the time when the Spaniards first arrived in this country. A new eruption happened in 1743, which had been for some days preceded by a continual interior rumbling noise; after which an aperture was made in its summit, as also three others near the middle of its declivity; these parts, when the eruption commenced, were buried under prodigious masses of snow. The ignited substances which were ejected being mingled with a considerable quantity of snow and ice, melting amidst the flames, were carried down with such amazing rapidity, that the plain from Callo to Latacunga was overflowed, and all the houses with their wretched inhabitants were swept away in one general and instantaneous destruction. The river of Latacunga was the receptacle of this dreadful flood, till becoming swollen above its banks, the torrent rolled over the adjacent country, continuing to sweep away houses and cattle, and rendered the land near the town of the same name as the river one vast lake. Here, however, the inhabitants had sufficient warning to save their lives by flight, and retreated to a more elevated spot at some distance. During three days the volcano ejected cinders, while torrents of lava with melted ice and snow poured down the sides of the mountain. The eruption continued for several days longer, accompanied with terrible roarings of the wind, rushing through the craters which had been opened. At length all was quiet, and neither smoke nor fire were to be seen; until in May 1744 the flames forced a passage through several other parts on the sides of the mountain; so that in clear nights the flames, being reflected by the transparent ice, exhibited a very grand and beautiful illumination. On the 13th of November following, it ejected such prodigious quantities of fire and lava, that an inundation equal to the former soon ensued, and the inhabitants of the town of Latacunga for some time gave themselves over for lost.

The most southern mountain of the Cordilleras is that of Mecas or Sangay, which is of a prodigious height, and the far greatest part of it covered with snow; yet from its summit issues a continual fire, attended with explosions which are plainly heard at 40 leagues distance. The country adjacent to this volcano is entirely barren, being covered with cinders ejected from its mouth. In this mountain rises the river Sangay, which being joined by the Upano, forms the Payra, a large river which discharges itself into the Maranon.

Pichincha, though famous for its great height, is 1278 yards lower than the perpendicular height of Cotopaxi, and was formerly a volcano, but the mouth or crater on one of its sides is now covered with sand and calcined matter; so that at present neither smoke nor fire issue from it. When Don George Juan and Don Antonio de Ulloa were stationed on it for the purpose of making astronomical observations, they found the cold on the top of this mountain extremely intense, the wind violent, and they were frequently involved in so thick a fog, or, in other words, a cloud, that an object at six or eight paces distance was scarcely discernible. The air grew clear, by the clouds moving nearer to the earth, and on all sides surrounding the mountain to a vast distance, representing the sea with the mountain standing like an island in the centre. When this happened, they heard the dreadful noise of the tempests that discharged themselves on Quito and the neighbouring country. They saw the lightning issue from the clouds, and heard the thunder roll far beneath them. While the lower parts were involved in tempests of thunder and rain, they enjoyed a delightful serenity; the wind was abated, the sky clear, and the enlivening rays of the sun moderated the severity of the cold. But when the clouds rose, their thickness rendered respiration difficult; snow and hail fell continually, and the wind returned with all its violence; so that it was impossible entirely to overcome the fear of being, together with their hut, blown down the precipice on whose edge it was built, or of being buried in it by the constant accumulations of ice and snow. Their fears were likewise increased by the fall of enormous fragments of rocks. Though the smallest crevice visible in their hut was stopped, the wind was so piercing that it penetrated through; and though the hut was small, crowded with inhabitants, and had several lamps constantly burning, the cold was so great, that each individual was obliged to have a chafing-dish of coals, and several men were constantly employed every morning to remove the snow which fell in the night. By the severities of such a climate their feet were swelled, and so tender that walking was attended with extreme pain, their hands covered with chilblains, and their lips so swelled and chopt that every motion in speaking drew blood.

57 Province of Lima. The next division of Peru is the audience of Lima, which is bounded on the north by Quito, on the east by the Cordilleras of the Andes, on the south by the audience of Los Charcos, and on the west by the Pacific ocean, it being about 770 miles in length from north to south, being of an unequal breadth.

58 Climate, soil, &c. in this province. The climate and soil of this country is uncommonly various; in some places it is exceedingly hot, in others insupportably cold; and in the city of Lima, where rain never falls, it is always temperate. The seasons vary within the compass of a few miles, and in certain parts of the audience all the vicissitudes of weather are experienced in 24 hours. It is extremely remarkable that no rains fall or rivers flow on the sea coasts, though the country is refreshed by thick fogs, and the heat abated by dense clouds that never condense into showers. This phenomena has drawn the attention of many naturalists, without their being able satisfactorily to account for it.

Spring begins toward the close of the year, that is about the end of November or the beginning of December, when the vapours which fill the atmosphere during the winter subside, and the sun, to the great joy of the inhabitants, again appears, and the country then begins to revive, which, during the absence of his rays, had continued in a state of languor. This is succeeded by summer, which, though hot from the perpendicular direction of the sun's rays, is far from being insupportable; the heat, which indeed would otherwise be excessive, being moderated by the south winds, which always blow at this season, though with no great force. Winter begins at the latter end of June or the beginning of July, and continues till November or December, when the south winds begin to blow stronger, and to produce a certain degree of cold, not indeed equal to that in countries where ice and snow are known, but so keen that the light dresses are laid by, and cloth or other warm stuffs worn. During the winter the earth is covered with so thick a fog, as totally to intercept the rays of the sun: and the winds, by blowing under the shelter of this fog, retain the particles they contracted in the frozen zone. In this season only the vapours dissolve into a very small dew, which everywhere equally moistens the earth; by which means all the hills, which during the other parts of the year offer nothing to the sight but rocks and wastes, are clothed with verdure and enamelled with flowers of the most beautiful colours. These dews never fall in such quantities as to impair the roads or incommode the traveller; a very thin stuff will not soon be wet through; but the continuance of the mists during the whole winter, without being exhaled by the sun, fertilizes every part of the country.

From a table of meteorological observations made in the city of Lima, from the month of March 1791, to March 1792, it appears that the thermometer was lowest during the month of September, when it descended to 62°, and that it was highest in the month of March, when it rose as high as 84°. These temperatures denote the extremes of heat and cold in the winter and summer of this climate.

Lima is as free from tempests as from rain, so that those of the inhabitants who have neither visited the mountains nor travelled into other parts, are absolute strangers to thunder and lightning, and are therefore extremely terrified when they first hear the former or see the latter. But it is very remarkable, that what is here entirely unknown should be so common 30 leagues to the east of Lima; it being no farther to the mountains, where violent rains and tempests of thunder and lightning are as frequent as at Quito.

But though the capital is freed from the terror of these tempests, it is subject to what is much more dreadful. Earthquakes happen here so frequently, that the inhabitants are under continual apprehensions of being, from their suddenness and violence, buried in the ruins of their own houses: yet these earthquakes, though so sudden, have their presages, one of the principal of which is a rumbling noise in the bowels of the earth about a minute before the shocks are felt, that seems to pervade all the adjacent subterraneous part; this is followed by dismal howlings of the dogs, who seem to presage the approaching danger. The beasts of burden passing the streets stop, and by a natural instinct spread open their legs, the better to secure themselves from falling. On these portents the terrified inhabitants fly from their houses into the streets with such precipitation, that if it happens in the night they appear quite naked; the urgency of the danger at once banishing all sense of delicacy or shame. Thus the streets exhibit such odd and singular figures as might afford matter of diversion, were it possible to be diverted in so terrible a moment. This sudden concourse is accompanied with the cries of children waked out of their sleep, blended with the lamentations of the women, whose agonizing prayers to the saints increase the common fear and confusion. The men are also too much affected to refrain from giving vent to their terror; so that the whole city exhibits a dreadful scene of consternation and horror.

The earthquakes that have happened at the capital are very numerous. The first since the establishment of the Spaniards was in 1582; but the damage was much less considerable than in some of the succeeding. Six years after Lima was again visited by another earthquake, so dreadful, that it is still solemnly commemorated every year. In 1609 another happened, which overturned many houses. On the 27th of November 1630, such prodigious damage was done in the city by an earthquake, that, in acknowledgement of its not having been entirely demolished, a festival on that day is annually celebrated. Twenty-four years after, on the 3d of November, the most stately edifices in the city, and a great number of houses, were destroyed by an earthquake; but the inhabitants retiring, few of them perished. Another dreadful one happened in 1678; but one of the most terrible was on the 28th of October 1687.

1687. It began at four in the morning, and destroyed many of the finest public buildings and houses, in which a great number of the inhabitants perished; but this was little more than a prelude to what followed; for two hours after, the shock returned with such impetuous concussions, that all was laid in ruins, and the inhabitants felt themselves happy in being only spectators of the general devastation, by having saved their lives, though with the loss of all their property. During this second shock, the sea retired considerably, and then returning in mountainous waves, entirely overwhelmed Callao, which is at five miles distance from Lima, and all the adjacent country, together with the miserable inhabitants. From that time six earthquakes have happened at Lima previous to that of 1746. This last was on the 28th of October, at half an hour after ten at night, when the concussions began with such violence, that in little more than three minutes the greatest part, if not all the buildings in the city, were destroyed, burying under their ruins those inhabitants who had not made sufficient haste into the streets and squares, the only places of safety. At length the horrible effects of the first shock ceased; but the tranquillity was of short duration, the concussions swiftly succeeding each other. The fort of Callao also sunk into ruins; but what it suffered from the earthquake in its building was inconsiderable, when compared to the dreadful catastrophe which followed; for the sea, as is usual on such occasions, receding to a considerable distance, returned in mountainous waves, foaming with the violence of the agitation, and suddenly buried Callao and the neighbouring country in its flood. This, however, was not entirely effected by the first swell of the waves; for the sea retiring farther, returned with still greater impetuosity, and covered both the walls and other buildings of the place; so that whatever had escaped the first inundation was totally overwhelmed by those succeeding mountainous waves. Twenty-three ships and vessels, great and small, were then in the harbour, 19 of which were sunk, and the other four, among which was a frigate named St Fermin, were carried by the force of the waves to a considerable distance up the country. This terrible inundation and earthquake extended to other parts on the coast, and several towns underwent the same fate as the city of Lima; where the number of persons who perished within two days after it began, amounted, according to the bodies found, to 1300, besides the maimed and wounded, many of whom lived only a short time in great torture. The present population of this city, taken from accurate sources, amounts to 52,627.

The country of Lima enjoys great fertility, producing all kinds of grain and a prodigious variety of fruit. Here industry and art supply that moisture which the clouds withhold. The ancient incas of Peru caused small canals to be formed, in order to conduct the waters of the rivers to every part of the country. The Spaniards, finding these useful works executed to their hands, had only to keep them in order; and by these are watered spacious fields of barley, large meadows, plantations, vineyards, and gardens, all yielding uncommon plenty. Lima differs from Quito, where the fruits of the earth have no determined season; for here the harvest is gathered in, and the trees drop their leaves in the proper season.

Although the summer here is hot, yet venomous creatures are unknown; and the same may be said of the territory called *Valles*, though here are some parts, as Tumbez and Piura, where the heat is almost as great as that of Guayaquil. This singularity can therefore proceed from no other cause than the natural drought of the climate.

59 Divisions of the audience of Lima.

The audience of Lima is divided into four bishoprics, Truxillo, Guamanga, Cusco, and Arequipa. The diocese of Truxillo lies to the north of the archiepiscopal diocese of Lima, and like all the others is divided into several jurisdictions. The city of Truxillo is seated in 8° 6′ south latitude, in a pleasant situation, though in a sandy soil.

In the diocese of Guamanga is a rich quicksilver mine, from which the inhabitants of a neighbouring town procure their whole subsistence; the coldness of the air in that place checking the growth of all kinds of grain and fruit, so that they are obliged to purchase them from their neighbours. The quicksilver mines wrought here supply all the silver mines in Peru with that necessary mineral, and notwithstanding the prodigious quantities already extracted, no diminution is perceived.

Cusco, which gives name to another diocese, is the most ancient city of Peru, being of the same date with the empire of the incas, and was founded by them as the capital of the empire. On the mountain contiguous to the north part of the city are the ruins of a famous fort built by the incas; whence it appears that their design was to inclose the whole mountain with a prodigious wall, of such construction as to render its ascent absolutely impracticable to an enemy, in order to prevent all approach to the city. This wall was entirely of freestone, and strongly built, some of the stones being of a prodigious magnitude. The city of Cusco is nearly equal to that of Lima. See CUSCO.

In this bishopric are several mines of gold and silver, that are extremely rich.

The fourth diocese of the audience of Lima is Arequipa, which contains the city of the same name, one of the largest in Peru. It is delightfully situated in a plain; the houses are well built of stone, and are generally lofty, commodious, finely decorated on the outside, and neatly furnished within. The temperature of the air is extremely agreeable, the cold being never excessive, or the heat troublesome; so that the fields are always clothed with verdure, and enamelled with flowers, as in a perpetual spring. But these advantages are allayed by its being frequently exposed to dreadful earthquakes; for by these convulsions of nature it has been four times laid in ruins. The city is, however, very populous, and among its inhabitants are many noble families.

In this bishopric are several gold and silver mines, and in some parts are large vineyards, from which considerable quantities of wine and brandy are made. Among the other productions is Guinea pepper, in which the jurisdiction of Arica in this diocese carries on a very advantageous trade, the annual produce of these plantations bringing in no less than 60,000 dollars per annum. The pods of this pepper are about a quarter of a yard in length, and when gathered are dried in the sun and packed up in bags of rushes, each bag containing an aroba or a quarter of a hundred weight, and thus they are exported to all parts. Other places of this jurisdiction are famous for vast quantities of large and excellent olives, far exceeding the finest produced in Europe, being nearly, it is said, the size of a hen s egg.

60 The audience of Charcas. The audience of Charcas, the last division of Peru, is equal in extent to that of Lima; but many of its parts are not so well inhabited, some being full of vast deserts and impenetrable forests, while others have extensive plains intercepted by the stupendous height of the Cordilleras: the country is inhabited only in such parts as are free from those inconveniences. It is bounded on the north by the diocese of Cusco, and reaches southward to Buenos Ayres; on the east it extends to Brasil; and on the west it reaches to the Pacific ocean, particularly at Atacama. The remainder of the province borders on the kingdom of Chili.

61 Divisions. &c. of this audience. This audience is divided into the archbishopric of Plata, and five bishoprics. We shall begin with the former.

The famous mountain of Potosi is known all over the commercial world for the immense quantity of silver it has produced. The discovery of this amazing treasure happened at the commencement of the year 1545, by a mere accident, which we shall mention afterwards. At a small distance from it are the hot medicinal baths, called *Don Diego*, whither some resort for health and others for amusement.

62 How the country was at first settled by the Spaniards. At the time when the first conquests were made, when emigrations were most frequent, the country of the Incas had a much greater reputation for riches than New Spain; and, in reality, for a long time much more considerable treasures were brought away from it. The desire of partaking of them must necessarily draw thither, as was really the case, a greater number of Castilians. Though almost all of them went over thither with the hope of returning to their country to enjoy the fortune they might acquire, yet the majority settled in the colony. They were induced to this by the softness of the climate, the salubrity of the air, and the goodness of the provisions. Mexico presented not the same advantages, and did not give them reason to expect so much independence as a land infinitely more remote from the mother-country.

Cusco attracted the conquerors in multitudes. They found this capital built on a ground that was very irregular, and divided into as many quarters as there were provinces in the empire. Each of the inhabitants might follow the usages of his native country; but every body was obliged to conform to the worship established by the founder of the monarchy. There was no edifice that had any grandeur, elegance, or convenience; because the people were ignorant of the first elements of architecture. The magnificence of what they called the *palace of the sovereign*, *of the princes of the blood*, and *of the great men of his empire*, consisted in the profusion of the metals that were lavished in decorating them. The temple of the Sun was distinguished above all other edifices; its walls were incrusted or sheathed with gold and silver, ornamented with divers figures, and loaded with the idols of all the nations whom the Incas had enlightened and subdued.

As it was not a solicitude for their own preservation which occupied the Spaniards at first, they had no sooner pillaged the immense riches which had been amassed at Cusco for four centuries, than they went in great numbers in 1534, under the order of Sebastian de Benalcazar, to undertake the destruction of Quito. The other towns and settlements of the empire were overrun with the same spirit of rapine; and the citizens and the temples were plundered in all parts.

Those of the conquerors, who did not take up their residence in the settlements which they found already formed, built towns on the sea-coasts, where before there were none: for the sterility of the soil had not permitted the Peruvians to multiply much there; and they had not been induced to remove thither from the extremity of their country, because they sailed very little. Paita, Truxillo, Callao, Pisca, and Arica, were the roads which the Spaniards deemed most convenient for the communication they intended to establish among themselves and with the mother country. The different positions of these new cities determined the degree of their prosperity.

Those which were afterwards built in the inland parts of the country were not erected in regions which presented a fertile soil, copious harvests, excellent pastures, a mild and salubrious climate, and all the conveniences of life. These places, which had hitherto been so well cultivated by a numerous and flourishing people, were now totally disregarded. Very soon they exhibited only a deplorable picture of a horrid desert; and this wildness must have been more melancholy and hideous than the dreary aspect of the earth before the origin of societies. The traveller, who was led by accident or curiosity into these desolate plains, could not forbear abhorring the barbarous and bloody authors of such devastations, while he reflected that it was not owing even to the cruel illusions of glory, and to the fanaticism of conquest, but to the stupid and abject desire of gold, that they had sacrificed so much more real treasure, and so numerous a population.

This insatiable thirst of gold, which neither tended to subsistence, safety, nor policy, was the only motive for establishing new settlements, some of which have been kept up, while several have decayed, and others have been formed in their stead. The fate of them all has corresponded with the discovery, progress, or declension of the mines to which they were subordinate.

63 Manner of living of the natives. Fewer errors have been committed in the means of procuring provisions. The natives had hitherto lived hardly on any thing else but maize, fruits, and pulse, for which they had used no other seasoning except salt, and pimento. Their liquors, which were made from different roots, were more diversified: of these the chicha was the most usual; but the conquerors were not satisfied either with the liquors or with the food of the people they had subdued. They imported vines from the Old World, which soon multiplied sufficiently in the sands of the coasts at Ica, Pisca, Nasca, Moquequa, and Truxillo, to furnish the colony with the wine and brandy it wanted. Olives succeeded still better; and yielded a greater abundance of oil, which was much superior to that of the mother-country. Other fruits were transplanted with the same success. Sugar succeeds so well, that none of any other growth can be compared to that which is cultivated in those parts, where it never rains. In the inland country wheat and

barley were sown; and at length all the European quadrupeds were soon found grazing at the foot of the mountains.

This was a considerable step; but there still remained much more to be done. After they had provided for a better and a greater choice of subsistence, the next care of the Spaniards was to have a dress more commodious and more agreeable than that of the Peruvians. These were, however, better clothed than any other American nation. They owed this superiority to the advantage which they alone possessed, of having the LLAMA and PACOS, domestic animals which served them for this use. See CAMELUS, MAMMALIA *Index*.

After the conquest, all the Indians were obliged to wear clothes. As the oppression under which they groaned did not allow them to exercise their former industry, they contented themselves with the coarser cloths of Europe, for which they were made to pay an exorbitant price. When the gold and silver which had escaped the rapacity of the conquerors were exhausted, they thought of re-establishing their national manufactures. These were some time after prohibited, on account of the deficiency which they occasioned in the exports of the mother country. The impossibility which the Peruvians found of purchasing foreign stuffs and paying their taxes, occasioned permission to be given at the end of ten years for their re-establishment. They have not been discontinued since that time; and have been brought to as great a degree of perfection as it was possible they could be under a continual tyranny.

64
Manufactures, &c.

With the wool of the vicuna, a species of wild pacos, they make, at Cuzco, and in its territory, stockings, handkerchiefs, and scarfs. These manufactures would have been multiplied, if the spirit of destruction had not fallen on animals as well as on men. The same wool, mixed with that of the sheep imported thither from Europe, which have exceedingly degenerated, serves for carpets, and makes also tolerably fine cloth. Fleeces of inferior quality are employed in serges, druggets, and in all kinds of coarse stuffs.

The manufactures subservient to luxury are established at Arequipa, Cusco, and Lima. In these three towns is made a prodigious number of gold toys and plate, for the use of private persons, and also for the churches. All these manufactures are but coarsely wrought, and mixed with a great deal of copper. We seldom discover more taste in the gold and silver laces and embroideries which their manufactures also produce. This is not altogether the case in regard to their lace, which, when mixed with that of Europe, looks very beautiful. This last manufacture is commonly in the hands of the nuns, who employ in it the Peruvian girls, and the young Mestees of the towns, who for the most part before marriage pass some years in the convent.

Other hands are employed in painting and gilding leather for rooms, in making with wood and ivory pieces of inlaid work and sculpture, and in drawing figures on the marble that is found at Cucuca, or on linen imported from Europe. These different works, which are almost all manufactured at Cusco, serve for ornaments for houses, palaces, and temples: the drawing of them is not bad, but the colours are neither exact nor permanent. If the Indians, who invent nothing, but are excellent imitators, had able masters and excellent models, they would at least make good copyists. At the close of the last century, some works of a Peruvian painter, named *Michael de St Jacques* were brought to Rome; and the connoisseurs discovered marks of genius in them.

65
Of the mines of gold and silver.

Though the Peruvians were unacquainted with coin, they knew the use of gold and silver; for they employed them in different kinds of ornaments. Independent of what the torrents and accident procured them of these metals, some mines had been opened of little depth. The Spaniards have not transmitted to us the manner in which these rich productions were drawn from the bosom of the earth. Their pride, which has deprived us of so much useful knowledge, undoubtedly made them think, that, in the inventions of a people whom they called *barbarous*, there was nothing that was worthy to be recorded.

The difference as to the manner in which the Peruvians worked their mines, did not extend to the mines themselves. The conquerors opened them on all sides. At first the gold mines tempted the avarice of the greater number. Fatal experience discouraged those whom passion had not blinded. They clearly saw, that, for some enormous fortunes raised in this manner, great numbers who had only moderate fortunes, were totally ruined. These mines sunk into such discredit, that, in order to prevent them from being abandoned, the government was obliged to take the 20th part of their produce, instead of the fifth which it at first received.

The mines of silver were more common, more equal, and richer. They even produced silver of a singular species, rarely found elsewhere. Towards the seacoast, great lumps of this metal are found in the sands.

There are a greater number of other mines which are infinitely more important, and are found in the rocks and on the mountains. Several of them gave false hopes. Such, in particular, was that of Ucuntaya, discovered in 1713. This was only an incrustation of almost massive silver, which at first yielded several millions, but was soon exhausted.

Others which were deeper have been alike deserted. Their produce, though equal to what it was originally, was not sufficient to support the expence of working them, which augmented every day. The mines of Quito, Cusco, and Arequipa, have experienced that revolution which awaits many of the rest.

There are greater numbers of very rich mines which the waters have invaded. The disposition of the ground, which from the summit of the Cordilleras goes continually shelving to the South sea, must necessarily render these events more common at Peru than in other places. This inconvenience, which with greater care and skill might often have been prevented or diminished, has been in some instances remedied.

Joseph Salcedo, about the year 1660, had discovered, not far from the town of Puna, the mine of Laycacota. It was so rich, that they often cut the silver with a chisel. Prosperity had so elevated the mind of the proprietor, that he permitted all the Spaniards who came to seek their fortunes in this part of the New World, to work some days on their own account, without weighing or taking any account of the presents he made them. This generosity drew around him an infinite number of people, whose avidity made them quarrel with each other, and the love of money made them take up arms and fall upon one another; and their benefactor, who had neglected no expedient to prevent and extinguish their sanguinary contentions, was hanged as being the author of them. Whilst he was in prison, the water got possession of his mine. Superstition soon made it imagined that this was a punishment for the horrid act they had perpetrated against him. This idea of divine vengeance was revered for a long time; but at last, in 1740, Diego de Bacna associated with other opulent people to avert the springs which had deluged so much treasure. The labours which this difficult undertaking required, were not finished till 1754. The mine yields as much now as it did at first. But mines still richer than this have been discovered. Such, for example, is that of Potosi, which was found in the same country where the Incas worked that of Porco.

An Indian, named *Hualpa*, in 1545, pursuing some deer, in order to climb certain steep rocks laid hold of a bush, the roots of which loosened from the earth, and brought to view an ingot of silver. The Indian had recourse to it for his own use; and never failed to return to his treasure every time that his wants or his desires solicited him to it. The change that had happened in his fortune was remarked by one of his countrymen, and he discovered to him the secret. The two friends could not keep their counsel and enjoy their good fortune. They quarrelled; on which the indiscreet confidant discovered the whole to his master, Villaroell, a Spaniard who was settled in the neighbourhood. Upon this the mine became known, and was worked; and a great number of them were found in his vicinity; the principal of which are in the northern part of the mountain, and their direction is from north to south. The most intelligent people of Peru have observed, that this is in general the direction of the richest mines.

The fame of what was passing at Potosi soon spread abroad; and there was quickly built at the foot of the mountain a town, consisting of 60,000 Indians and 10,000 Spaniards. The sterility of the soil did not prevent its being immediately peopled. Corn, fruit, flocks, American stuffs, European luxuries, arrived there from every quarter. Industry, which everywhere follows the current of money, could not search for it with so much success as at its source. It evidently appeared that in 1738 these mines produced annually near 978,000l. without reckoning the silver which was not registered, and what had been carried off by fraud. From that time the produce has been so much diminished, that no more than one-eighth part of the coin which was formerly struck is now made.

At the mines of Potosi, and all the mines of South America, the Spaniards, in purifying their gold and silver, used mercury, with which they are supplied from Guança Velica. The common opinion is, that this mine was discovered in 1564. The trade of mercury was then still free: it became an exclusive trade in 1571. At this period all the mines of mercury were shut; and that of Guança Velica alone was worked, the property of which the king reserved to himself. It is now found to diminish. This mine is dug in a prodigiously large mountain, 60 leagues from Lima. In its profound abyss are seen streets, squares, and a chapel, where the mysteries of religion on all festivals are celebrated. Millions of flambeaux are continually kept to enlighten it.

Private people at their own expence work the mine of Guança Velica. They are obliged to deliver to government, at a stipulated price, all the mercury they extract from it. As soon as they have procured the quantity which the demands of one year require, the work is suspended. Part of the mercury is sold on the spot, and the rest is sent to the royal magazines throughout all Peru; from whence it is delivered out at the same price it is sold for in Mexico. This arrangement, which has occasioned many of the mines to drop, and prevented others from being opened, is inexcusable in the Spanish system. The court of Madrid, in this respect, merits the same reproaches as a ministry in other countries would incur, that would be blind enough to lay a duty on the implements of agriculture.

Peru originally included the provinces of Quito and Potosi, which are described with it in this article; but these provinces are now separated from it. The area of Peru, thus restricted in its limits, is 33,628 square leagues, as stated in the beginning of this article. The population by the last census amounted to 1,076,122 persons of all ages and conditions; but the returns are believed to be under the truth, and the real amount of the population is believed to be about 1,300,000. Of these four-tenths are Indians. The remainder is made up of European Spaniards, Spanish Creoles, Mestizoes, Negroes, Mulattoes, and Samboes. It is ascertained, from a census in 1551, that the present number of inhabitants in Peru, Santa Fe, and Buenos Ayres, does not much exceed one third of the number at the conquest.

Peru, in its present extent, contained in 1791, 69 mines of gold which were then wrought, 784 mines of silver, four of quicksilver, four of copper, 12 of lead. The whole produce of its silver mines for the ten years, ending in 1789, was 29,728,154 dollars; of its gold mines, 4,424,035. For both metals, the average annual produce was 3,415,218 dollars.

The produce of the royal duties from the mines of Potosi from 1556 to 1780—224 years, was 150,570,743 dollars. The corresponding produce of silver from the mines is 2,400,000,000 dollars. But, as a great part of the silver was smuggled, the actual produce of the mines must have been much greater.

The commerce of Peru with the adjacent provinces of Chili, Guayaquil, Panama, and Goatemala, employs 41 vessels of different sizes, the tonnage of which is 351,500 quintals; and they are manned by 1460 seamen. The annual imports in this trade for five years, ending 1789, was 2,066,824 dollars, and the exports 1,694,755. The imports of Peru from the mother country, for the five years ending 1779, were 23,838,183 dollars, or 4,767,636 annually; but, in the five years ending 1789, from the removal of certain restrictions on the trade, they had increased to 42,099,313 dollars, or 8,419,862 dollars annually. The exports were 21,302,385 dollars in the former period, and 35,979,339 in the latter.

The revenue of Peru amounts to nearly 5,000,000 dollars annually; but the clear revenue derived from the colony of Old Spain does not exceed 500,000 dollars.

Balsam of PERU. See MYROXILON, BOTANY and MATERIA MEDICA *Index*.

PERUGIA, a town of Italy, in the pope's territories, and capital of Perugino. It is an ancient, handsome, populous, and large city, with a strong citadel, an university, and a bishop's see. The churches, and many other buildings, as well public as private, are very handsome. It is seated on a hill, in E. Long. 12. 20. N. Lat. 43. 6.

PERUGINO, a province of Italy, in the territory of the church, bounded on the west by Tuscany, on the south by Orvietano, on the east by the duchies of Spoleto and Urbino, and on the north by the county of Citta Castellana. It is one of the smallest provinces in the territory of the church. The air is very pure, and the soil fertile in corn and good wine; besides, the lake Perugia supplies them with plenty of fish. The capital town is Perugia. The lake is eight miles from the city, and is almost round, being about five miles in diameter; in it there are three islands. This province is about 25 miles in length, and near as much in breadth.

PERUGINO. See MONTANINI.

PERUKE. See PERRUKE.

PERUVIAN BARK. See CINCHONA, and *JESUITS Bark*, MATERIA MEDICA *Index*.

PERUVIANA, a general name sometimes given to the vast peninsula of South America, extending itself from the isthmus of Darien to Cape Horn.

PESARO, a town of Italy, in the territory of the pope, and duchy of Urbino, with a bishop's see. The environs are remarkable for producing good figs, of which they send large quantities to Venice. It is seated on an eminence at the mouth of the river Fogha, on the gulf of Venice. E. Long. 13. 0. N. Lat. 43. 56.

PESCARA, a very strong town in the kingdom of Naples, and in the Hither Abruzzo; seated at the mouth of a river of the same name, which falls into the gulf of Venice. E. Long. 15. 2. N. Lat. 42. 27.

PESCENNIUS NIGER. See NIGER.

PESCHIERA, a small but strong town of Italy, in the Veronese, with a castle and a strong fort; seated on the river Mincio or Menzo, which proceeds from the lake Garda. E. Long. 11. 4. N. Lat. 42. 27.

PESENAS, an ancient town of France, in the department of Herault; delightfully seated on the river Pein, 12 miles north east of Besseirs, and eight north of Agde. E. Long. 3. 34. N. Lat. 43. 28.

PESSARY, in *Medicine*, a solid substance composed of wool, lint, or linen, mixed with powder, oil, wax, &c. made round and long like a finger, in order to be introduced into the exterior neck of the matrix, for the cure of several uterine disorders.

PEST, a town of Hungary, and now the capital of the kingdom. It is situated on the Danube opposite Buda, with which it communicates by a bridge of boats. It is the seat of the supreme courts of justice, of the offices of government, and of a well endowed university. The latter has a good museum and library. There are also here an hospital for invalids, and a theatre. The streets are spacious, and the houses generally handsome: the number of inhabitants is estimated at 42,000. Pest is the most commercial city in Hungary, and possesses some manufactures. E. Long. 19. 10. N. Lat. 47. 24.

PESTILENCE, in *Medicine*, the same with the PLAGUE.

PETAGUEL, a territory of South America, in Brasil; bounded on the north by Dele, on the east by the sea, on the south by the captainship of Rio-Grande, and on the west by Tupuya. It contains mines of silver.

PETAL, in *Botany*, one of the coloured leaves which compose the flower.

PETALISM, a mode of deciding on the guilt of citizens, similar to the Athenian OSTRACISM. It was introduced in Syracuse about the year before Christ 460, in order to prevent the tyranny of the richer citizens, who had often about that time aimed at the diadem. To prevent, therefore, the evils daily arising from thence, and to bring down the aspiring minds of the wealthy citizens, the Syracusans were forced to make a law not unlike that of the Athenian ostracism; for as at Athens every citizen was to write on a shell the name of the person whom they conceived to be the most likely, on account of his wealth and adherents, to aspire to the crown; so at Syracuse they were to write on a leaf the names of such as they apprehended powerful enough to usurp the sovereignty. When the leaves were counted, he who had the most suffrages against him was, without any further inquiry, banished for five years. This new-contrived method of impairing the estates, and weakening the interest of the overgrown citizens, was called *petalism*, from the Greek word *petalon*, which signifies "a leaf." This law was attended with many evil consequences; for those who were most capable of governing the commonwealth were driven out, and the administration of public affairs committed to the meanest of the people; nay, many of the chief citizens, who were able to render their country great service, fearing to fall under penalties of this law, withdrew from the city, and lived private in the country, not concerning themselves with public affairs: whence all the employments being filled with men of no merit or experience, the republic was on the brink of ruin, and ready to fall into a state of anarchy and confusion. The law therefore of petalism, upon more mature deliberation, was repealed soon after it had been first enacted, and the reins of government were again put into the hands of men who knew how to manage them.

PETARD, in the art of war. See GUNNERY.

PETAU, DENIS, or *Dionysius* PETAVIUS, a French Jesuit of great erudition, was born at Orleans in 1583. His father was a man of literature, and observing strong parts and an excellent genius for letters in his son, he took every means in his power to improve them. He used to tell his son, that he ought to qualify himself so, as to be able to attack and confound "the giant of the Allophylæ;" meaning that most eminent scholar Joseph Scaliger, whose abilities and learning were allowed to have done great honour and much service to the reformed. Young Petavius seems to have entered readily into his father's views; for he studied most intensely, and afterwards levelled much of his erudition against Scaliger. He joined the study of the mathematics to that of the belles lettres; and afterwards applied himself to a course of philosophy, which he began in the college of Orleans, and finished at Paris. He afterwards maintained theses in Greek, which was as familiar to him as Latin; and the Latin, it is said, he understood better than he did his own native language. When he was pretty well advanced, he had free access to the king's library, which he often visited on account of the Latin and Greek manuscripts. Among other advantages which accompanied his literary pursuits, was the friendship of Isaac Casaubon.

bon, whom Henry IV. called to Paris in 1600. It was at Casaubon's instigation, that Petavius, though then but very young, undertook an edition of The Works of Synesius. In this edition he corrected the Greek from the manuscripts, translated that part which yet remained to be translated into Latin, and wrote notes upon the whole. He was but 19 years of age when he was made professor of philosophy in the university of Bourges; and he spent the two following years in studying the ancient philosophers and mathematicians. In 1604, when Morel, professor of Greek at Paris, published The Works of Chrysostom, some part of Petavius's labours on Synesius were added to them: from the title of which we learn, that he then took the name of *Pætus*, which he afterwards changed into *Petavius*. His own edition of The Works of Synesius did not appear till 1612.

He entered into the society of the Jesuits in 1605, and did great credit to it by his vast and profound erudition. He became a zealous advocate for the church of Rome; and there was no way of serving it more agreeable to him than that of criticising and abusing its adversaries. He was most bitter against Scaliger; nor did he even spare his friend Casaubon whenever he came in his way.—Petavius excelled particularly in the dark science of chronology; the learned world in general being obliged to him for some exact and nice disquisitions on this subject. His chief work, which is in great repute to this day, he intitled, *Rationarium Temporum*. It is an abridgement of universal history, from the earliest times to 1632, in chronological order, with references to proper authorities. It was improved, and several additions made to it, by Perizonius, and others after his death. This eminent father, after a very laborious life, died at Paris in the end of the year 1652, aged 69. Gassendus, in his life of Pereschius, says he was the most consummate scholar the Jesuits ever had; an opinion very likely to be true, when we consider that he often contended successfully with Scaliger, Salmasius, and others, whose abilities have been universally acknowledged. His judgment, however, was not equal to his erudition, and his controversial writings are full of sourness and spleen. We have the following character of a great work of Petavius by an author of much celebrity, but who perhaps is as much biassed on the side of infidelity as he thinks this learned Jesuit was in favour of the church of Rome. The *Dogmata Theologica* of Petavius are a work of incredible labour and compass: the volumes which relate solely to the incarnation (two folios, 5th and 6th, of 837 pages) are divided into 16 books—the first of his history, the remainder of controversy and doctrine. The Jesuit's learning is copious and correct: his Latinity is pure, his method clear, his argument profound and well connected; but he is the slave of the fathers, the scourge of heretics, and the enemy of truth and candour, as often as they are inimical to the Catholic cause.

PETAW, an ancient town of Germany, in the circle of Austria, and in Stiria. It is a handsome place, and is seated on the river Drave, 35 miles north-east of Cilley, and 109 south of Vienna. E. Long. 15. 36. N. Lat. 46. 40.

PETCHELI, a province of Asia, in China, and the chief in the whole empire; bounded on the east by the sea, on the north by the great wall, on the west by Chansi, and on the south by Chantong and Honan. "This province contains nine cities of the first class, which have several others under their jurisdiction; these are about 40 in number, less considerable indeed, but all surrounded with walls and ditches. Petcheli has few mountains. Its soil is sandy, and produces very little rice; but all other kinds of grain abound there, as well as the greater part of the fruit-trees we have in Europe. It pays an annual tribute to the emperor, which, according to Father Martini, consists of 601,153 bags of rice, wheat, and millet; 224 pounds of linseed; 45,135 of spun silk; 13,748 of cotton; 8,737,248 trusses of straw for the horses belonging to the court, and 180,870 measures of salt, each containing 124 pounds; which is proportionally much inferior to that paid by other provinces. The population of this province is estimated at 38,000,000.

"It is remarked that the people of this province have not the same aptitude for acquiring the sciences as those who inhabit the southern provinces of the empire; but they are more robust and warlike; and better calculated to endure the hardships and fatigue of war. This is the case with the Chinese of all the other northern countries.

"The face of the country here being flat and level, permits the use of a kind of carriage, the construction of which appears to be rather singular. Father Martini, one of the first missionaries in China, thus describes it: 'They use, in the province of Petcheli, a kind of chariot with one wheel, and constructed in such a manner, that there is room in the middle for only one person, who sits as if on horseback; the driver pushes behind, and, by means of wooden levers, makes the chariot advance with safety and expedition.' This has perhaps given rise to the report of chariots driven in that country by the wind, which the Chinese direct over land with sails, as they do ships at sea. A French missionary, who traversed this province in 1768, seems to have made use of the same kind of carriage. 'We quitted the canal (says he) to travel in carts, which is customary in this part of China; but it is disagreeable beyond description. The cart is amazingly clumsy, and has a great resemblance to the carriage of a gun: there is room in it for only one person, who is frequently obliged to sit cross-legged, as our taylors do in Europe; it jolts prodigiously; and, while the traveller is exposed to the scorching rays of the sun, such clouds of dust sometimes arise as almost suffocate him.'

"The temperature of the air of this province does not seem to agree with its latitude. Although Petcheli extends no farther than to the 42d degree of north latitude, yet all the rivers there are so much frozen during four months in the year, that horses and waggons with the heaviest loads may safely pass them. It deserves to be remarked, that the whole body of ice is formed in one day, and that several are necessary to thaw only the surface. What may appear no less extraordinary is, that during these severe frosts one does not feel that sharp and pinching cold which accompanies the production of ice in Europe. These phenomena cannot be accounted for, but by attributing them to the great quantity of nitre which is found dispersed throughout this province, and to the serenity of the sky, which, even during winter, is seldom obscured by a cloud. The physical explanation, which we have given of this singular temperature, is fully confirmed by experiments lately made by Father Amiot at Peking, which convinced him, that in this capital and neighbourhood, as far as seven or eight leagues round, the water, air, and earth, equally abound with nitre.

"With regard to the water, the facility with which it freezes, the solidity of the ice and its duration, evidently announce the presence of nitre. A tub filled with water, placed near one of Reaumur's thermometers, had its surface immediately frozen, when the mercury stood only one degree above the freezing point; and when it stood three degrees below freezing, the water became a solid mass of ice, if the diameter of the vessel did not exceed a foot and a half, and the depth of the water four or five inches. This water, when the weather was fine, continued in the same state of congelation as long as the mercury in the thermometer did not rise higher than three degrees above 0; when the mercury rose higher, it then began to dissolve, but so slowly, that two or three days were scarcely sufficient to restore it to its former fluidity." Grosier goes on to relate other experiments of Father Amiot, which were made with a view to discover the cause of the water's freezing so in this temperate climate; and he then proceeds to tell us, that "if the waters of the province of Petcheli contain much nitre, it is no less certain, that the air which one breathes there is abundantly impregnated with it. The following are indubitable proofs of it: 1st, Notwithstanding unwholesome food, such as the flesh of the greater part of domestic animals that have died of old age or disease, which the people of this province greedily devour, notwithstanding filth and all the inconveniences resulting from low, damp, and confined lodgings, where all the individuals of the same family are, as it were, heaped one upon another, the plague never makes its appearance in Petcheli; and the people are seldom attacked by any of those epidemical distempers which are so common in Europe. 2dly, Provisions of every kind may be kept at Peking a long while, without being subject to corruption. Raisins are eaten there fresh even in May, apples and pears till midsummer; wild boars, stags, deer, roebucks, rabbits, hares, pheasants, ducks, geese, and all kinds of game, brought from Tartary to Peking after the commencement of winter; fish of every species, transported from the rivers of Leatong, will keep without the assistance of salt, in their state of congelation, for two or three months, although they are exposed every day in the markets, carried from the markets to private houses, and from private houses brought back to the markets until they are all sold, which does not happen before the end of March. It is certain that these facts announce an antiseptic quality in the air, which must undoubtedly proceed from the great quantity of nitre contained it.

"3dly, The earth which forms the soil of Petcheli abounds no less with nitre; whole fields may be seen in the neighbourhood of Peking which are covered with it. Every morning at sunrise, the country in certain cantons appears white as if sprinkled by a gentle fall of snow. If a quantity of this substance be swept together, a great deal of kien, nitre, and salt, may be extracted from it. The Chinese pretend that this salt may be substituted for common salt; however this may be, it is certain, that in the extremity of the province towards Siuen-hoa-fou, poor people, and the greater part of the peasants, make use of no other. With regard to the kien procured from the earth, they use it for washing linen as we do soap. Although the land of Petcheli be replete with nitrous particles, it does not, however, form dry deserts; it is cultivated with care, and becomes fruitful by incessant labour. The earth is frozen in winter to the depth of two or three feet, and does not become soft before the end of March. This may explain why the frost kills plants in the neighbourhood of Pekin, which Linnæus raised in Sweden, although it is 20 degrees farther north than the capital of the Chinese empire. See China, Supplement.

PETECHIÆ, in *Medicine*, a name given to those spots, whether red or of any other colour, which appear in malignant fevers.

PETELIA. See Strongoli.

PETER, St, the apostle, born at Bethsaida, was son of John, Jona, or Joana, and brother of St Andrew (John i. 42. 43.). His first name was Simon or Simeon; but when our Saviour called him to the apostleship, he changed his name into Cephas, that is, in Syriac, a *stone* or a *rock;* in Latin *petra*, whence *Peter*. He was a married man; and had his house, his mother-in-law, and his wife, at Capernaum upon the lake of Gennesareth (Mark i. 29. Matth. viii. 14. Luke iv. 38.). St Andrew having been first called by Jesus Christ, met his brother Simon, and told him (John i. 41.) we have found the Messiah, and then brought him to Jesus. Jesus beholding him, said to him, You are Simon son of Jona; henceforth you shall be called *Cephas*, that is, *stone* or *rock*. After having passed one day with our Saviour, they returned to their ordinary occupation, which was fishing. Yet it is thought they were present with him at the marriage of Cana in Galilee. This happened in the 30th year of the vulgar Christian era.

Towards the end of the same year, Jesus Christ being on the shore of the lake of Gennesareth, saw Peter and Andrew busy about their fishery, and washing their nets, (Luke v. 1, 2, 3.). He entered into their boat, and bid Peter throw out his nets into the sea, in order to fish. Peter obeyed him, though he had already fished the whole night without catching any thing. They took so many fishes at this draught, that their own vessel, and that of James and John, sons of Zebedee, were filled with them. Then Peter threw himself at the feet of Jesus, and said to him, Depart from me, Lord, for I am a sinner. Then Jesus said to them, Follow me, and I will make you fishers of men. He said the same thing to James and John; and immediately they quitted their boats and nets, and followed our Saviour.

Some time after, Jesus coming to Capernaum, entered into the house of St Peter, where his mother-in-law lay sick of a fever. He immediately healed her, and she began to minister to him (Luke iv. 38. and Matt. viii. 14.). A little while before the feast of the passover of the following year, being the 32d of the vulgar era, after Jesus returned into Galilee, he made choice of twelve apostles, among which St Peter has always the first place (Matt. x. 2. Luke vi. 13.). One night that Jesus Christ walked upon the waters of the lake of Gennesareth, St Peter asked him leave to come and meet him (Matt. xiv. 28, 29.). Jesus gave him leave; but he seeing a great wave coming, was afraid, and therefore began to sink. Then Jesus held him up, and said, O man of little faith, why was you afraid? Afterwards landing on the other side of the lake, and the multitude that he had fed the day before beyond the lake being come to him at Capernaum, he spoke to them of his body and of his blood, which he was to give to his disciples to eat and drink. This so offended the multitude, that several of them quitted him thereupon. He therefore asked his apostles if they also would leave him; to which Peter replied, To whom shall we go, Lord; for thou hast the words of eternal life (John vi. 53, 54, &c.). One day, as our Saviour was near Cæsarea Philippi, he asked his apostles whom the world took him for? they answered, that some said he was John the Baptist; others, Elias; and others Jeremiah, or one of the prophets. But whom do you say I am? says Jesus Christ. Simon Peter answered, Thou art Christ, the son of the living God. Jesus then said unto Peter, Blessed art thou Simon Barjona; for flesh and blood hath not revealed it unto thee, but my father which is in heaven (Mat. xvi. 13, 14, &c.). And I say unto thee, that, as thou art Peter, so upon this rock will I build my church, and the gates of hell shall not prevail against it; and I will give unto thee the keys of the kingdom of heaven, and whatsoever thou shalt bind on earth shall be bound in heaven, and whatsoever thou shalt loose upon earth shall be loosed in heaven. About six or eight days after this, our Saviour taking Peter, James, and John, up a high mountain, apart from the other disciples, showed them a glimpse of his glory, and was transfigured before them (Mat. xvii. 1, 2, &c. and Luke ix. 28.). Whereupon Peter, seeing Moses and Elias together with Jesus, cried out to them in an ecstacy, Lord, it is good for us to be here! if you please we will make three tents; one for you, one for Moses, and one for Elias.

Jesus returning from thence to Capernaum, those who gathered the tribute money came to Peter, and said, Does not your master pay tribute? Whereupon Jesus ordered Peter to throw his line into the sea, and that he should find wherewith to pay the toll for them two in the mouth of the first fish he should take. Peter obeyed; and finding a piece of money in the mouth of the fish, he gave it to the tribute-gatherers, as he was directed. One day, as Jesus was discoursing concerning the forgiveness of injuries (Mat. xviii. 21, 22.), St Peter asked him, how often they must forgive, and whether it was sufficient to pardon an offender seven times? Jesus told him, I say, you must pardon not only as far as seven times, but even seventy-times seven. Upon another occasion (Mat. xix. 27—29.), as our Saviour was speaking of the danger of riches, Peter said to him, Lord, we have left all things to follow thee; what reward shall we have for it? Jesus answered him, I tell you in truth, that you who have left all things to follow me shall receive an hundred fold even in this world, and in the other eternal life; and at the last day, when the Son of man shall come to judge the world, you shall sit upon twelve thrones to judge the twelve tribes of Israel.

On the Tuesday before our Saviour's passion, Peter showed him the fig-tree he had cursed the evening before, which was now dried up and withered (Mark xi. 12—21.); and the day following, as they sat upon the mountain of Olives, he, with the other apostles, asked Jesus when the temple was to be destroyed (Mat. xxiv. 1, 2, &c. Mark xiii. 1, 2, &c. Luke xxii.). On Thursday he was sent with St John to prepare all things for the passover; and at evening, when Jesus was come into the city with his apostles, and being sat down at table, began to speak of him that should betray him, Peter made signs to John to ask him who this should be (John xiii. 24.). After supper, the disciples entered into dispute which should be the greatest among them: whereupon Jesus Christ, laying aside his garments, betook himself to wash their feet, to give them an example of humility in his own person. St Peter at first made some difficulty, and would not suffer his master to wash his feet: but Jesus telling him, that if he did not wash his feet, he could have no part in him; St Peter replied, Lord, wash not only my feet, but my hands and head also (John xiii. 6—10.).

Some time after, Jesus said to him (Luke xxii. 31, 32, &c.), Peter, Satan has desired to sift you as men sift wheat; but I have prayed for you, that your faith may not fail: and when you are converted, confirm your brethren. By this he warned St Peter of his fall, that was just at hand, and of his renouncing him; from which by the assistance of God, he was afterwards to recover. St Peter then asked him, where he was going? and said, he was ready to follow him everywhere, not only to prison, but to death itself. But Christ declared to him, that he would be so far from following him to death that he would abjure him three times that very night before the cock should crow, or before break of day. When supper was ended, he went to the garden of Olives, where, taking Peter, James, and John, he went with them apart, that they might be witnesses of his agony. Peter, though before he had showed so much resolution, yet fell asleep with the rest; which occasioned Jesus to say to him, Do you sleep, Simon? Could you not watch with me one hour? (Mark xiv. 37. Mat. xxvi. 40, &c.).

Judas being come with the soldiers to seize Jesus, Peter drew his sword, and cut off the right ear of one called Malchus, who was servant to the high-priest: but Jesus bid him put up his sword into the scabbard, and told him, that all those who fought with the sword should perish by the sword: and at the same time healed Malchus's ear (John xviii. 10, &c.). Peter followed Jesus afar off, as far as the house of Caiaphas, and was let in by means of another disciple, who was known in the family. The soldiers and servants that had brought Jesus, having lighted a fire in the middle of the hall, Peter mingled among them to warm himself also; when a maid-servant, having looked earnestly upon him, said, Surely this man was with Jesus of Nazareth. But Peter made answer, I know not what you say, for I do not so much as know the man. Presently after he went out into the porch, when immediately the cock crew. A little while after another maid said to those that were present, This man was with Jesus of Nazareth. But Peter denied it with an oath. About an hour after, one of the company affirmed that Peter was a disciple of Jesus. Others insisted upon the same thing; and said that surely he was one of them, for his very speech betrayed him to be a Galilean. Lastly, one of them, being a kinsman of Malchus whose ear Peter had cut off, affirmed the same thing; and asked him, Did not I see you with him in the garden? Peter again denied it with an oath, protesting that he did not know the man. And at the same time the cock crowed the second time. Then Jesus, being in the same hall, and not far from Peter, looked upon him; and Peter then remembering what Jesus had said to him, that before cock-crow he should deny him thrice, he went out of Caiaphas's house, and wept bitterly (Mat. xxvi. 73, 75. Mark xiv. 34, 72.).

Very probably he remained in secret, and in tears, all the time of our Saviour's passion, that is, all Friday and Saturday following; but on Sunday morning, Jesus being risen, and Mary having been at the tomb, and not finding the body of Jesus, she came in haste into the city, to tell Peter and John that they had taken away their master, and that she could not find where they had put him. Peter and John made haste thither, and John coming first, did not go into the sepulchre. Peter then coming up to him, presently stooped down, and saw the linen clothes wherein the body had been wrapt. He went then into the sepulchre, and John with him; after which they returned to Jerusalem, not knowing what had come to pass. But soon after Jesus appeared to the holy women, who had come first to the sepulchre, and bid them give his apostles notice of his resurrection. And the same day our Saviour also appeared to Peter, to comfort him, and assure him that his repentance had been acceptable to him.

Some days after, St Peter being returned into Galilee as Jesus had commanded him, and going to fish in the sea of Galilee, or in the lake of Gennesareth, with some other of the apostles, Jesus appeared to them on the shore, and bid them throw out their nets on the right side of the vessel. They threw them out, and took such a multitude of fishes that they could not draw up their nets again. Then St John said to Peter, It is the Lord. Peter immediately girded up himself, for he was naked, and swimming to shore he came to Jesus: then drawing their nets to shore, Jesus dined with them. After dinner, Jesus said to Peter, Simon, son of Jona, do you love me more than these? He answered, Yea, Lord, you know that I love you. Jesus says to him, Then feed my lambs. He put the same question to him again; and Peter making the same answer, our Lord said to him again, Feed my sheep. This he repeated a third time; at which St Peter was troubled, and said, You know, Lord, that I love you. Jesus replied to him, "Feed my sheep. I tell you for a truth, that when you were young, you girded yourself, and went where you pleased; but now you are old, another shall gird you, and lead you where you would not go." This he said to let him know what death he was to die. At the same time, Peter seeing St John the Evangelist, said to our Saviour, Lord, what must become of him? Jesus answered, "If I will that he tarry till I come, what does that concern you? Do you follow me." Thus he refused to declare in what manner St John should end his life.

After that Jesus Christ had ascended into heaven, and that the apostles had been witnesses of his ascension, they returned to Jerusalem, to wait there for the Holy Ghost, whom our Saviour had promised to send them; and being assembled together in a house, they continued there in prayer, and in the union of charity, till the time that the Holy Ghost descended upon them, in the form of tongues of fire. During this interval, St Peter proposed to the apostles, and to the rest of the assembly, to fill up the place that the traitor Judas had left vacant in the apostleship. The proposal was agreed to by all; and two persons were proposed, Joseph Barsabas and Matthias: upon this last the lot fell; and from that time he was admitted one of the apostles. The tenth day after the ascension of our Saviour, being the day of Pentecost, the Holy Ghost having descended upon the apostles, and upon all the faithful that were assembled with them, and having replenished them with supernatural gifts, and especially with the gift of tongues, all those who were witnesses of this miracle expressed their admiration at it; and there being upon that day at Jerusalem a great many Jews from several provinces of the east, they could not comprehend by what means these men, who were Galileans, should speak the languages of all these pagan nations (Acts ii. 1, 2, &c.). Some of them said, that the apostles were full of new wine. But St Peter standing up, told them, that what they heard and saw was not the effect of drunkenness, but was the completion of the promise that the Holy Ghost had made by the prophet Joel (ii. 28.), to send his spirit upon all flesh, and to give the spirit of prophecy to young and old, to men and women. He afterwards spoke to them of Jesus Christ, and told them that he was the true Messiah, that he was risen from the dead as the scripture had foretold he should; declaring that himself and the other apostles were witnesses of his resurrection, of his ascension into heaven, and of the mission of the Holy Ghost, the visible effects of which they saw with their own eyes in the gifts of languages wherewith they had been replenished.

Then those that heard him were touched with compunction, and asked the apostles, Brethren, what shall we do? Peter answered them, Repent, and be baptized, and you shall receive the Holy Ghost. Then he instructed them, baptized them, and that very day three thousand persons were added to the church (Acts iii. 1, 2, &c.). Some days after, St Peter and John, going to the temple at the hour of prayers, met at a gate of the temple a man who had been lame from his birth, so that he was carried about. This man seeing Peter and John, asked alms of them: upon which Peter said to him, Silver or gold I have not; but such as I have I give thee: In the name of Jesus of Nazareth, rise up and walk. Presently the man got up, and went into the temple along with them, lifting up his voice, and glorifying God. He held St Peter, telling the people then assembled all that had happened unto him. Then Peter, taking this occasion, told the people, that it was not by his own power that he had performed the miracle they so much wondered at, but that it was by the power of Jesus Christ that this man was healed. He then laid before them the great crime they had committed, in putting Jesus Christ to death, who was the Saviour of the world, and the Messiah; and after he had shewn them by all the prophecies that Christ was to die thus, he exorted them to repentance, and to make a proper use of the death of Christ.

He was thus speaking to the people, when the priests and Sadducees coming upon them, laid hold on Peter and John, and put them in prison, until the day following, it being now late (Acts iv. 1, 2, &c.). But the number of those that were converted this day at the second preaching of St Peter was about five thousand. The day following, the rulers, magistrates, and chief priests being assembled on this occasion, ordered the apostles to be brought before them; and then asked them, by whose authority they performed the miracle of healing the lame man? St Peter answered, that it was in the name of Jesus of Nazareth, whom they had crucified, and whom God raised again from the dead. The assembly were surprised at the boldness of the apostles upon this occasion: but came to a resolution to dismiss them, charging them at the same time to teach no more in the name of Jesus; and threatening them if they should persist in disobedience to these orders. The two apostles returned to their brethren, and related to them all that had passed; which having heard, the brethren raised their voices to heaven, begging God to give them strength and courage to declare his word with perfect liberty; and having finished their prayers, the place shook wherein they were assembled, and they were again filled with the Holy Ghost.

At this time many of the faithful sold their estates, and brought the money to the apostles (*id.* v. 1, 2, &c.). Of this number was a man called Ananias, with his wife Sapphira, who, by a private agreement between themselves, concealed a part of the money for which they had sold their land, and brought the rest to St Peter, as if it were the whole sum. Ananias came first; and St Peter said to him, Ananias, how came Satan to seduce you, and prevail with you to lie to the Holy Ghost, by concealing part of the price of your land? It is not men that you thought to impose on, but God. Immediately Ananias fell down dead, and they carried him out and buried him. About three hours after, his wife Sapphira came in, and St Peter said to her almost the same things he had before said to her husband, and immediately she fell down also, and gave up the ghost. This affair infused a great awe in the whole church, and amongst all those that heard of it. (See Acts v.).

The number of believers considerably increased every day; so that they even brought out the sick into the streets, and laid them where Peter was to pass, that at least his shadow might cover some of them, by which means they were healed of their distempers. Then the high-priest and his associates, that is, the Pharisees, caused the apostles to be apprehended and put into prison. But an angel brought them forth, and bid them go into the temple, and there boldly declare all the words of life which God had taught them. This they performed: upon which the princes and priests caused them to be brought before them; and having demanded why they had disobeyed their orders in continuing to speak still in the name of Jesus Christ, Peter and the apostles answered, that it was more necessary to obey God than man. This answer provoked them very much, and they were going to condemn them to death, when Gamaliel prevailed with them to change their resolution, by representing to them, that if this matter proceeded from God, it was in vain for them to oppose it; but if otherwise, then it should soon vanish of itself. So they dismissed the apostles, after giving them 39 stripes a-piece, and charged them to speak no more in the name of Jesus Christ.

After the martyrdom of St Stephen, a persecution was carried on against the faithful at Jerusalem, and they were obliged to take shelter in several places. The apostles alone continued at Jerusalem (Acts viii. 1, 2, 3, &c.). St Philip the deacon going to Samaria, the Samaritans received the word of the Lord, and several of them were baptized. Then St Peter and St John repaired thither also, to give them the Holy Ghost; which St Philip, being only a deacon, had not power to do. Simon the magician was also baptized among others; and admiring the power that the apostles had, of conferring the Holy Ghost, would have bought the same power of the apostles, and accordingly offered money to St Peter. But Peter with indignation replied to him, Thy money and thou perish together, who thinkest the gifts of God can be bought with money! Thou hast no part with us, nor hast any pretensions to this ministry, for thy heart is not right before God. Repent therefore of this wickedness, and pray to God if perhaps he will pardon the wicked thoughts of thy heart. After this Peter and John returned again to Jerusalem. See Acts viii.

The fire of persecution being now pretty well extinguished, St Peter departed from Jerusalem (Acts ix. 32, &c.), and visiting the disciples from city to city, he came also to see the saints that dwelt at Lydda. Here he found a man called Æneas, who had been paralytic for eight years. St Peter said to him, Æneas, rise up; Jesus Christ the Lord cures you. He presently got up; and all that dwelt at Lydda that saw the miracle were converted to the Lord. There was also at Joppa a certain holy woman, named Tabitha, who happening to die while St Peter was at Lydda, the disciples sent to desire him to come to them. Whereupon St Peter came, and entering into the chamber where Tabitha lay dead, he caused every body to go out, and betook himself to prayers. Then turning himself towards the corpse, he said, Tabitha, arise. At which instant she opened her eyes, and seeing St Peter, she sat up. This miracle was much-famed at Joppa, and was the occasion that many were converted. St Peter stayed there a good while, taking up his lodging with one Simon a tanner.

Now there was at Cæsarea of Palestine a centurion called Cornelius, a man that feared God (Acts x. 1, 2, 3.), and to whom it was revealed by an angel, that he should send to Joppa to Peter, who should tell him what he had to do. Cornelius immediately sent two of his servants; and while they were upon the road, the Lord sent a vision to Peter, to prepare him to go to this man without any scruple, although he was not a Jew; for as yet the door of the gospel had not been opened to the Gentiles. St Peter, then being at the top of the house, fell into a trance, and saw, as it were, a great sheet of linen let down from heaven, which was full of all kinds of animals and reptiles, both clean and unclean. He had this vision three times, and heard a voice, saying, Arise Peter, kill and eat. But Peter answered, Lord, I have never eaten any thing unclean. The voice replied, Call not that unclean which God has purified. After which the sheet was again taken up into heaven. At the same time, the men came in that had been sent by Cornelius. They acquainted him with what had happened to their master, and desired him to go along with them to Cæsarea. The day following St Peter set out thither, and was accompanied by some of the brethren of Joppa. (See Acts x.).

When Peter was returned to Jerusalem, the faithful of the circumcision said to him, why have you gone unto the uncircumcised, and why do you eat with them? but Peter having related to them all that passed, they were satisfied, and glorified God who had given the gift of repentance leading to life as well to the Gentiles as to the Jews. It is thought, that a little after this Peter went to Antioch, where he founded the Christian church of which he was bishop (Gal. ii. 11.). It is believed that he continued here seven years, though not constantly: for during this time, he went to Jerusalem, and to the provinces of Asia Minor, to Bithynia, Cappadocia, and Pontus, as is concluded from the epistle that he afterwards addressed to the faithful of these provinces. From thence he went to Rome, in the 42d year of the Christian era; and it is thought that at his leaving Antioch he there fixed St Ignatius in his place. Eusebius thinks, that the chief occasion of his going to Rome was to oppose Simon Magus, who by his deceits had perverted a great number of persons. However, the presence of St Peter, and the true miracles that he opposed to the tricks of Simon, ruined, or much diminished, the reputation of this impostor.

St Peter, leaving Rome, came to Jerusalem at the passover, in the 44th year of the Christian era, when Herod Agrippa began to persecute the church. That prince put St James the Greater, brother of John, to the sword (Acts xii. 1. &c.); and perceiving that his death was agreeable to the Jews, he moreover caused Peter to be apprehended and put in prison, with a design of executing him publicly after the passover. But the very night that Herod thought of putting him to death, as Peter, loaded with chains, was asleep between two soldiers, the angel of the Lord awakened him, broke off his chains, opened the prison door, and brought him out the length of the street. Then the angel leaving him, he came to the house of Mary the mother of John, where many of the faithful were assembled at prayers; and having knocked at the door, a damsel named Rhoda came to open it; but when she heard Peter's voice, instead of opening the door, she ran in a transport of joy to acquaint the family that Peter was at the door. Those who heard her could not believe it, and said it was his angel, and not himself: but continuing to knock, and being let in, he informed them of what had happened to him.

He then left Jerusalem; but we are not told what became of him till the time of the council held at Jerusalem in the year 51. It is thought that before this time he made his second journey to Rome, from whence he wrote his first epistle.

St Peter was obliged to leave Rome in the year 51 by order of the emperor Claudius, who had banished all Jews from thence, because of the tumults they continually raised there, excited by one Chrestus, as Suetonius says, meaning probably by this name Jesus Christ. The apostle then returned into Judea, where was held the council of Jerusalem; in which, after a strict examination of the matter proposed to Peter and the apostles, he spoke to them with much wisdom, saying (Acts xv. 7, 8, &c.) that God having given his Holy Ghost and the gift of faith to the Gentiles as well as to the Jews, they ought not to impose the yoke of the legal observances on the new converts, which (as he says) neither we nor our fathers have been able to bear. But we believe, that it is through the grace of Jesus Christ that both we and they shall be saved. St James the Less, bishop of Jerusalem, seconded this opinion of St Peter; and the council came to this conclusion, That no new obligation should be imposed on the Gentiles, but only that they should be required to abstain from fornication, from the use of blood, and from meats offered to idols. The resolution of this council was written to the faithful of Antioch, because it was there this question was first started.

Some time after, St Peter coming to Antioch (Gal. ii. 11. &c.), he ate and drank with the Gentiles, without regarding that distinction of meats enjoined by the law. But after that, when some of the faithful of Jerusalem came to Antioch, being converted Jews, St Peter, out of fear to offend them, separated himself from the converted Gentiles, and would no longer eat with them as before. St Paul, fearing that what St Peter did, might be interpreted, as if he had a desire to oblige the Gentiles to judaize, and to submit themselves to the yoke of the law, and so to revoke and annul what he himself had determined in the council of Jerusalem, he withstood Peter to his face, and openly expostulated with him, telling him he was much in the wrong to endeavour to oblige the Gentiles, at least tacitly by his own manner of acting, to live as the Jews do; and St Peter received this reprehension with silence and humility.

The particulars of St Peter's life are little known from the 51st year of the vulgar era, in which the council of Jerusalem was held, till his last journey to Rome, which was some time before his death. Then being acquainted by revelation that the time of his death was not far off (2 Pet. i. 14.), he had a mind to write to the faithful that had been converted by him, to put them in mind of the truths he had before taught them. He sent them therefore his second epistle.

St Peter and St Paul came to Rome about the same time, in the year of Christ 65, where they performed many miracles, and made many converts. Simon Magus by his tricks continued here to deceive the people, pretending himself to be the Messiah, and even attempting to ascend into heaven; for having caused himself to be carried up into the air by his dæmons, in a fiery chariot, St Peter and St Paul betook themselves to their prayers; and then the impostor, being forsaken by his dæmons, fell down upon the ground, which fall some time afterwards occasioned his death. See SIMON MAGUS.

Soon after this St Peter was taken up and thrown into prison, where it is said he continued for nine months; at last he was crucified at Rome in the Via Ostia; with his head downwards, as he himself had desired of his executioners. This he did out of a sense of humility, for fear it should be thought, as St Ambrose says, that he affected the glory of Jesus Christ, and the more to augment the pain of his execution.

It is said, that the body of St Peter was at first buried in the catacombs, two miles from Rome, from whence it was afterwards transported to the Vatican, where it has lain ever since. His festival is celebrated with that of St Paul on the 29th of June. St Peter died in the 66th year of the vulgar era, after having been bishop of Rome for about 24 or 25 years. His age might be about 74 or 75 years. It is generally agreed, that St Linus was his successor. The following is the portraiture that Nicephorus gives us of St Peter, which he has probably taken from the ancient pictures that were preserved of this apostle. He was not fat, but pretty tall and upright, having a fair and palish countenance. The hair of his head and beard was thick, frizzled, and not long. His eyes were black, and blood-shot; his eyebrows protuberant and lofty; his nose something long, and rather flat than sharp.

The two epistles of St Peter are addressed to those Jewish converts who were scattered throughout Pontus, Galatia, &c. not only upon the persecution raised at Jerusalem, but upon former dispersions of the Jews into those places on several other occasions. The first epistle is principally designed to comfort and confirm them under those fiery trials and manifold temptations they were then subject to, and to direct and instruct them how to behave in the several states and relations both of the civil and the Christian life, that they might not be engaged in those rebellions against Cæsar and his officers, then fomented among the Jews; and that they might stop the mouths of those who spoke against them as evil doers. In the second epistle, he prosecutes the same subject, to prevent their apostasy from the faith, on account of any persecutions they were liable to. He likewise guards them against the corrupt principles of the Gnostics, and those who scoffed at the promise of Christ's coming, as if it would never be verified.

Blackwell's Sacred Classics defended.

St Peter's style, says a modern author, expresses the noble vehemence and fervour of his spirit, the full knowledge he had of Christianity, and the strong assurance he had of the truth and certainty of his doctrine; and he writes with the authority of the first man in the college of the apostles. He writes with that quickness and rapidity of style, with that noble neglect of some of the formal consequences and niceties of grammar, still preserving its true reason and natural analogy (which are always marks of a sublime genius), that you can scarce perceive the pauses of his discourse and distinction of his periods. The great Joseph Scaliger calls St Peter's first epistle majestic; and we hope he was more judicious than to exclude the second, though he did not name it.

A noble majesty, and becoming freedom, is what distinguishes St Peter; a devout and judicious person cannot read him without solemn attention and awful concern The conflagration of this lower world, and future judgment of angels and men, in the third chapter of the second, is described in such strong and terrible terms, such awful circumstances, that in the description we see the planetary heavens and this our earth wrapped up with devouring flames, hear the groans of an expiring world, and the crashes of nature tumbling into universal ruin.

The authority of the second epistle of St Peter was for some time doubted of, as Origen, Eusebius, St Jerome and others have observed. What made the ancients call it in question, is the difference of its style from the first. The third chapter, which describes the catastrophe of the visible world, made Grotius think this epistle was wrote after the taking of Jerusalem; because that was not to happen till after the destruction of that city; upon which he conjectures, that Simeon bishop of Jerusalem is the author of this epistle, and that the inscription which carries St Peter's name is corrupted. But the best critics admit this epistle to be the genuine work of St Peter, who discovers himself, where he says, that he was present at our Lord's transfiguration; and where he tell the Jews, this was the second letter he had written to them. The reader may see this question fully discussed, and the authority of this epistle established beyond all doubt, by the learned Dr Sherlock, in his *Dissertation* on the authority of the Second Epistle of St Peter.

St Peter has been made the author of several books; such were, his Acts, his Gospel, his Revelation, his work about preaching, and another about judgment. There is extant a large history of St Peter, called the *Recognitions*, ascribed to St Clement.

Peter of Blois, a learned man of the 12th century, was born about the year 1120, at the city of Blois in France, from whence he derived his name. His parents, being opulent, gave him a learned education. In his youth, when he studied in the university of Paris, he was excessively fond of poetry; and when he was a little further advanced in life, he became no less fond of rhetoric, to the study of which he applied with the greatest ardour. From Paris he removed to Bononia in Italy, to acquire the civil and canon law; in the knowledge of both which he very much excelled. He appears from his writings to have cultivated medicine, and several branches of the mathematics, with no little care and success. The study of theology was the chief delight and business of his life, in which he spent the greatest part of his time, and made the greatest progress. But unfortunately it was that scholastic theology, which consisted in vain attempts to prove and explain the many absurd opinions which then prevailed in the church, by the subtleties of Aristotelian logic. In attempting to explain in this manner the most absurd of all opinions that ever existed amongst mankind, he was the very first person who employed the famous word *transubstantiation*, which was soon after adopted by the church of Rome, and hath ever since made so great a noise. Being appointed preceptor to William II. king of Sicily in 1167, he obtained the custody of the privy seal; and, next to the archbishop of Palermo, the prime minister, had the greatest influence in all affairs. But his power was not of long duration; for the archbishop being banished in 1168, our author soon after left the court of Sicily, and returned into France. He was not long, however, without a royal patron, being invited into England by Henry II. who employed him as his private secretary, made him archdeacon of Bath, and gave him some other benefices. When he had spent a few years at court, he conceived a disgust at that way of life (of which he hath drawn a very unpleasing picture in one of his letters), and retired into the family of Richard archbishop of Canterbury, who had made him his chancellor about the year 1176. In this station he continued to the death of the archbishop in 1183, enjoying the highest degree of favour with that prelate, though he used much freedom in reproving him for his remissness in the government of the church. Our author remained in the same station in the family of Archbishop Baldwin, who succeeded Richard, acting both as his secretary and chancellor. He was also sent by that prelate on an embassy to Rome in 1187, to plead his cause before

fore Pope Urban III. in the famous controversy between him and the monks of Canterbury about the church of Hackington. After the departure of his friend and patron Baldwin for the Holy Land in 1190, our author was involved in various troubles in his old age, the causes of which are not distinctly known; and died about the end of the 12th century. He appears from his works, which may be justly reckoned among the most valuable monuments of the age in which he flourished, to have been a man of great integrity and sincere piety, as well as of a lively inventive genius and uncommon erudition. His printed works consist of 134 letters, which he collected together at the desire of Henry II.; of 65 sermons, delivered on various occasions; and of 17 tracts on different subjects.

Peter the Hermit. See CROISADE and HERMIT.

PETER I. justly styled *Peter the Great*, czar, and afterwards emperor, of Russia, founder of the Russian empire; for though the country was well known, and of great antiquity, yet it had no extent of power, of political influence, or of general commerce, in Europe, till his time. He was born in 1672; and was proclaimed czar when but ten years of age, in exclusion of John his eldest brother, who, being of a sickly constitution, was at the same time very weak in his understanding. The princess Sophia, his half-sister, made an insurrection in favour of John; and to put an end to the civil war, it was at last agreed that the two brothers should jointly share the imperial dignity. Peter had been very ill brought up, not only through the general defects of the Russian education, but likewise through the arts of the princess Sophia, who surrounded him with every thing that might stifle his natural desire of knowledge, deprave his mind, and enervate it with pleasures. Notwithstanding this, his inclination for military exercises discovered itself in his tenderest years. He formed a company of 50 men, commanded by foreign officers, clothed and exercised after the German manner. He entered himself into the lowest post, that of a drummer; and never rose otherwise than as a soldier of fortune. Herein his design was to teach his nobility, that merit, not birth, was the only title to military employments. He reinforced his company with several others, till at last he had got together a considerable body of soldiers. As he then had no war on his hands, he exercised them in all sorts of mock engagements, and by this means secured to himself a body of well-disciplined troops. The sight of a Dutch vessel, which he had met with on a lake belonging to one of his pleasure-houses, made such an impression on his mind, that he conceived the almost impracticable design of forming a navy. His first care was to get some Hollanders to build some small vessels at Moscow; and he passed two successive summers on board English or Dutch ships, which set out from Archangel, that he might instruct himself in every branch of naval affairs (A). In 1696 czar John died, and Peter was now sole master of the empire. In 1698 he sent an embassy to Holland; and went *incognito* in the retinue, and visited England, as well as Holland, in order to inform himself fully in the art of ship-building. At Amsterdam he worked in the yard as a private ship-carpenter, under the name of *Peter Michaelof*; but he has been often heard to say, that if he had never gone to England, he had still remained ignorant of that art. In 1700 he had got together a body of standing forces, consisting of 30,000 foot; and now the vast project he had formed displayed itself in all its parts. He opened his dominions, which till then had been shut up, having first sent the chief nobility of his empire into foreign countries to improve themselves in knowledge and learning. He invited into Russia all the foreigners he could meet with, who were capable of instructing his subjects in any manner, and offered them great encouragement to settle in his dominions. This raised many discontents; and the despotic authority he exerted on that occasion was scarcely powerful enough to suppress them. In 1700, being strengthened by the alliance of Augustus king of Poland, he made war on Charles XII. king of Sweden. His first ill success did not deter him; for he used to say, I know that my armies must be overcome for a great while; but even this will at last teach them to conquer. He afterwards gained considerable advantages; and founded Petersburg in 1703. In 1709 he gained a complete victory over the Swedes at Pultowa. In 1712 he was inclosed by the Turks on the banks of the Pruth; and seemed inevitably lost, had not the czarina Catherine bribed the grand visir, and the czar's prudence completed his deliverance. In 1716 he made a tour through Germany and Holland, and visited the royal academy of sciences at Paris. It would be endless to enumerate all the various establishments for which the Russians are obliged to him. He formed an army according to the manner of the politest and most experienced nations: he fitted out fleets in all the four seas which border upon Russia: he caused many strong fortresses to be raised after the best plans; and made convenient harbours: he introduced arts

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(A) The following circumstance, it is said, in some measure determined Peter to attempt those reformations which he afterwards accomplished. Great events have been sometimes the effect of little causes; and it is at least possible, that without the occurrence we are going to relate, Russia might still have been in a state of barbarism. A young Genevese, called *Le Fort*, about 1695, went to Moscow with the Danish ambassador. The czar Peter, who was then 19 years old, met with this Genevese, who had soon learnt the Russian tongue, and spoke almost all the languages of Europe. Le Fort ingratiated himself with the prince, entered into his service, and soon afterwards into his familiarity. He made him comprehend that there was a different manner of living and reigning from what had unhappily obtained throughout his vast and miserable empire. A prince must be born with an uncommon greatness of soul to listen readily to a stranger, and to be able to divest himself of the prejudices of a throne and of his country. The czar was sensible that neither himself nor his people were yet to be reckoned among men; and that he had an empire to form, but could have no assistance at home. From that time he took a resolution to leave his dominions; and set out, like another Prometheus, to borrow celestial fire for animating his countrymen.

arts and sciences into his dominions, and freed religion from many superstitious abuses: he made laws, built cities, cut canals, &c; was generous in rewarding, impartial in punishing; faithful, laborious, and humble; yet was not free from a certain roughness of temper natural to his nation. He had indeed cured himself of excess in drinking; but he has been branded with several other vices, particularly cruelty. He published the unfortunate history of his son Prince Alexis (B); towards whom some blame his severity, while others think it no more than was necessary. He perfectly knew the honour due to persons of merit; and not only heaped honours upon them during their life, but gave them marks of esteem even after their death. He died of the strangury in 1725, and left the world with the magnanimity of a hero and the piety of a Christian.

Peter was tall of stature, and of a bold and majestic aspect, though sometimes disfigured by convulsions, which altered his features. This deformity was ascribed to poison, given him, as it is said, by his sister Sophia; but it was indeed no other than wine and brandy, which he often drank to excess, relying too much on the strength of his constitution. He conversed with persons in all stations, from the mechanic to the general of an army; and his conversation was neither like that of a barbarian who makes no distinction between men, nor of a popular prince who seeks to please all the world, but that of a person who aims at instruction. He loved women as much as the king of Sweden, his rival, dreaded them, and all were equally agreeable to him; he valued himself on drinking large draughts, rather than sipping delicious wine. We are told that kings and legislators should never suffer themselves

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(B) Alexis, like his father, is said to have married a slave, and, like him, quitted Muscovy secretly, but had not the same success in his undertakings; and the being but a bad imitator of his father, cost him his life. He became an example of the most terrible severity that ever was given from the tribunal of the throne: but, what is much to the honour of the empress Catherine, she had no hand in the misfortunes of that prince, who was born of another woman, and loved nothing that his father loved. Catherine was not in the least suspected of acting the cruel stepmother. The great crime of the unfortunate Alexis was his being too much a Russian, and his disapproving every thing that was grand and immortal, and projected by his father for the glory of the nation. One day, hearing some Muscovites lamenting the insupportable fatigues they were to undergo in the building of Petersburg, he said, "Take courage, this city will not stand long." When he was called to attend his father in a journey of 600 or 700 leagues, which the czar often made, he feigned sickness. He took violent purges for a distemper which he had not; and such quantities of medicines, with excessive drinking of brandy, impaired his health and his wits. At first he had an inclination to learning, was acquainted with geometry and history, and had learnt the German tongue: but he hated war, and would never learn it; for which he was most reproached by his father. They had married him in 1711 to the princess of Wolfenbuttle, sister of the empress consort to Charles VI. This marriage was unfortunate; the princess was often abandoned for a debauch in brandy, and for Afrosina, a Finland wench, of a large stature, well made, and very agreeable. It is reported that the princess died of chagrin, if it be possible for chagrin to prove mortal; and that afterwards the czarowitz secretly espoused Afrosina in 1713, when the empress Catherine had just brought him a brother, at which he had no reason to be uneasy.

The misunderstandings between the father and the son became every day more serious; till at length the father, about the year 1716, threatened the prince to disinherit him; and the prince told him that he intended to go into a monastery.

The czar, in 1717, renewed his journeys, as well with a view to politics as curiosity. He came at last into France. If the son had entertained an inclination to revolt, if he had actually had a party formed in his favour, now was the time to declare himself; but instead of remaining in Russia, making himself popular, and creating dependents, he took a journey in his turn, having with much difficulty scraped together some thousands of ducats which he had secretly borrowed. He threw himself under the protection of the emperor Charles VI. brother of his deceased wife. They kept him for some time *incognito* at Venice, from whence he passed to Naples, where he resided almost a year, while neither his father nor any person in Russia knew the place of his retreat.

While the son kept himself thus concealed, the father was at Paris, where he was received with all the respect paid him in other places, but with a gallantry nowhere to be found but in France. If he went to visit a manufactory, and one piece of work attracted his sight more than another, he was presented with it the next day. He went to dine at the duke d'Antin's at Petitbourg, where the first thing he saw was his own picture at full length, in the same habit that he wore. When he was at the royal mint of medals, they struck all kinds before him, and presented him with them; at last they struck one which they let drop on purpose at his feet, and left him to take it up. He there saw himself perfectly engraven with these words, *Peter the Great*. The reverse was a Fame, and round her in letters *Vires acquirit eundo;* an allusion no less just than flattering to a prince who really acquired new merit by travelling.

After he had seen this country, where every thing disposes men to gentleness and indulgence, he returned to his own, and resumed his severity. He had engaged his son to return from Naples to Petersburg, from whence that young prince was conducted to Moscow before the czar his father; who began with depriving him of his succession to the throne, by making him sign a solemn act of renunciation at the end of January 1718, in consideration of which act the father promised the son to spare his life.

It was not altogether improbable that such an act would have been some time or other annulled. The czar, therefore, themselves to be transported by passion; but never was any man more passionate than Peter the Great, or more merciless. In a king this is more than an infirmity for which we make amends by confessing it; but it was generally remarked of Peter, and he himself said to a magistrate of Holland, at his second voyage, "I have reformed my nation, and have not been able to reform myself." It is true, the cruelties with which he is reproached were not novelties at the court of Moscow, any more than at that of Morocco: it was not uncommon to see a czar, with his own royal hand, inflict 100 lashes on the naked shoulders of a prime officer of the crown, or of a lady of the palace, for failing in their duty, by getting drunk; or to try the goodness of his sabre, by striking off the head of a criminal. Peter had himself performed some of those ceremonies of his country; Le Fort, however (see note A), had authority enough over him at times to stay his hand even when lifted up to strike, but he had not Le Fort always near him.

The czar's first marriage is thus related in the memoirs of Peter Henry Bruce, Esq. "It took place in 1690, when he was only 18. He was married to Ottokessa Lapuchin, a boyar's daughter, by whom he had Prince Alexis; some time after he turned her away and shut her up in a monastery, on suspicion of infidelity. It was said, that in one of her jealous fits she charged Prince Menzikoff with carrying the czar to drabs of his former acquaintance, who had been his customers for cakes; upbraiding him with his first occupation: and that Menzikoff ever after bore an irreconcileable enmity to both her and her son. After the divorce, one Miss Mons, a very beautiful young lady, born at Moscow, of foreign parents, as much in favour with the czar; but when he was abroad, Mr Keyserling, then residing at Moscow as envoy from the king of Prussia, paid his addresses to, and married her. When the czar returned, he was so much offended at Keyserling, that he ordered him to leave Moscow, which occasioned his immediate recal by the king his master, who sent another in his room. It was believed, if his public character had not protected him, he would have severely felt his majesty's displeasure.

"The czar was some time after smitten with the charms of another beautiful young lady, the daughter of a foreign merchant in this city: he first saw her in her father's house, where he dined one day. He was so much taken with her appearance, that he offered her any terms she pleased, if she would live with him; which this virtuous young woman modestly refused: but dreading the effects of his authority, she put on a resolution, and left Moscow in the night, without communicating her design even to her parents. Having provided a little money for her support, she travelled on foot several miles into the country, till she arrived at a small village where her nurse lived with her husband and their daughter, the young lady's foster-sister, to whom she discovered her intention of concealing herself in the wood near that village: and to prevent any discovery, she set out the same night, accompanied by the husband and daughter. The husband being a timber-man by trade, and well acquainted with the wood, conducted her to a little dry spot in the middle of a morass, and there he built a hut for her habitation.

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therefore, in order to give it more force, forgetting that he was a father, and only remembering that he was the founder of an empire, which his son might overturn, and involve in its ancient barbarity, ordered a public process to be drawn up against that unfortunate prince, for some concealment, with which he was charged, in the confession that they had exacted of him.

An assembly was held of the bishops, inferior ecclesiastics, and professors; who found in the Old Testament, that those who cursed their father or their mother should be put to death; that David indeed had pardoned Absalom, who had rebelled against him, but that Absalom was never pardoned by God. Such was their opinion, without drawing any conclusion; but it was in effect signing a warrant for his death. Alexis had not in fact cursed his father, neither had he ever revolted like Absalom; he had never lain publicly with the king's concubines; but he had left the kingdom without his father's permission, and had written letters to his friends in which he only signified that he hoped they would one day be mindful of him in Russia. But whatever might be his case, of 124 lay judges, who were appointed to sit on him, there was not one that judged his offences less than capital; and those who could not write, made others sign for them. It is reported in Europe, that the czar had got translated from Spanish into Russian the criminal process against Don Carlos, that unfortunate prince whom his father Philip I. had confined in a prison, where the heir of that great monarchy ended his days. But there was nothing like a process carried on against Don Carlos, nor was it ever known whether that prince died a natural or a violent death. Peter, the most despotic of princes, wanted not an example. Certain it is that the prince died the day after the sentence, and that the czar had at Moscow one of the best apothecary's shops in Europe. It is probable, however, that the prince Alexis, the heir of the most extensive empire in the world, being condemned unanimously by his father's subjects, which were one day to be his own, might die of the sudden shock and change given to the body at the apprehension of so strange and dismal a sentence. The father went to see his son in his last agonies; and it is said he shed tears. *Infelix utcunque ferent ea fata nepotes.* These tears, however, did not prevent the wheels from being covered with the broken limbs of his son's friends. He beheaded his own brother-in-law Count Lapuchin, brother to his wife Ottokessa Lapuchin whom he had divorced, and uncle to Prince Alexis. The prince's confessor had also his head cut off. If Muscovy has been civilized, she has, it must be confessed, paid dear for her improvement.

The remainder of the czar's life was nothing but a series of grand projects, labours, and exploits, that seemed to efface the memory of his excessive severities, which were perhaps necessary. He made frequent speeches to his court and to his council. In one he told them that he had sacrificed his son to the welfare of his dominions.

tation. She had deposited her money with her nurse to procure little necessaries for her support, which were faithfully conveyed to her at night by the nurse or her daughter, by one of whom she was constantly attended in the night time.

"The next day after her flight, the czar called at her father's to see her, and finding the parents in anxious concern for their daughter, and himself disappointed, fancied it a plan of their own concerting. He became angry, and began to threaten them with the effects of his displeasure if she was not produced: nothing was left to the parents but the most solemn protestations, with tears of real sorrow running down their cheeks, to convince him of their innocence, and ignorance of what was become of her; assuring him of their fears that some fatal disaster must have befallen her, as nothing belonging to her was amissing, except what she had on at the time. The czar, satisfied of their sincerity, ordered great search to be made for her, with the offer of a considerable reward to the person who should discover what was become of her, but to no purpose: the parents and relations, apprehending she was no more, went into mourning for her.

"Above a year after this she was discovered by an accident. A colonel who had come from the army to see his friends, going to hunt in the wood, and following his game through the morass, he came to the hut, and looking into it saw a pretty young woman in a mean dress. After inquiring of her who she was, and how she came to live in so solitary a place, he found out at last that she was the lady whose disappearance had made so great a noise; in the utmost confusion, and with the most fervent intreaties, she prayed him on her knees that he would not betray her; to which he replied, that he thought her danger was now past, as the czar was then otherwise engaged, and that she might with safety discover herself, at least to her parents, with whom he would consult how matters should be managed. The lady agreed to this proposal; and he set out immediately, and overjoyed her parents with the happy discovery; the issue of their deliberation was to consult Madame Catherine (as she was then called) in what manner the affair should be opened to the czar. The colonel went also upon this business, and was advised by Madame to come next morning and she would introduce him to his majesty, when he might make the discovery and claim the promised reward. He went according to appointment; and being introduced, told the accident by which he had discovered the lady, and represented the miserable situation in which he found her, and what she must have suffered by being so long shut up in such a dismal place, from the delicacy of her sex. The czar showed a great deal of concern that he should have been the cause of all her sufferings, declaring that he would endeavour to make her amends. Here Madame Catherine suggested, that she thought the best amends his majesty could make, was to give her a handsome fortune and the colonel for a husband, who had the best right, having caught her in pursuit of his game. The czar, agreeing perfectly with Madame Catherine's sentiments, ordered one of his favourites to go with the colonel, and bring the young lady home; where she arrived to the inexpressible joy of her family and relations, who had all been in mourning for her. The marriage was under the direction and at the expence of the czar, who himself gave the bride to the bridegroom; saying, that he presented him with one of the most virtuous of women; and accompanied his declaration with very valuable presents, besides settling on her and her heirs three thousand rubles a-year. This lady lived highly esteemed by the czar, and every one who knew her. Besides the concurring reports of other people, I had the story from her own mouth."

On the whole, that Peter I. was a great man, few will deny who know what real greatness is. A minute account of the life of this distinguished emperor would make a large volume; we have been able to give but the mere outlines of it: the anecdotes, however at the end, show in some degree the nature of the man; at all events they show one important truth, that it is a more difficult thing to reform one's self than to reform a kingdom; to conquer one's passions, than to conquer the world. The Russians, however, if there be any good in civilization, owe to him every thing: and they seem to be sensible of it; for a very pompous oration was delivered to his memory by Michael Lomonossoff, before the Academy of Sciences at St Petersburgh, on the 26th of April 1755. For a minuter account of his improvements, &c. see RUSSIA, PETERSBURGH, and CATHERINE I.

PETER the Wild Boy. This extraordinary creature occasioned great speculation among the learned; but we do not know that any satisfactory causes have been assigned for the striking difference between him and other human beings.

The following account of him is extracted from the parish-register of North-church, in the county of Hertford. "Peter, commonly known by the name of *Peter the Wild Boy*, lies buried in this churchyard, opposite to the porch. In the year 1725 he was found in the woods near Hamelen, a fortified town in the electorate of Hanover, when his majesty George I. with his attendants, was hunting in the forest of Hertswold. He was supposed to be then about 12 years of age, and had subsisted in those woods upon the bark of trees, leaves, berries, &c. for some considerable length of time. How long he had continued in that wild state is altogether uncertain; but that he had formerly been under the care of some person, was evident from the remains of a shirt collar about his neck at the time when he was found. As Hamelen was a town where criminals were confined to work upon the fortifications, it was then conjectured at Hanover that Peter might be the issue of one of those criminals, who had either wandered into the woods and could not find his way back again, or being discovered to be an idiot was inhumanly turned out by his parents, and left to perish or shift for himself. In the following year 1726, he was brought over to England, by the order of Queen Caroline then princess of Wales, and put under the care of Dr Arbuthnot with proper masters to attend him. But notwithstanding there appeared to be no natural defect in his organs of speech, after all the pains that had been taken with him he could never be brought distinctly to articulate a single syllable, and proved totally incapable of receiving any instruction. He was afterwards intrusted to the care of Mrs Titchbourn, one of the queen's bedchamber women, with a handsome pension annexed to the charge. Mrs Titchbourn usually spending a few weeks every summer at the house of Mr James Fenn, a yeoman farmer at Axter's

End in this parish, Peter was left to the care of the said Mr Fenn, who was allowed 35l. a-year for his support and maintenance. After the death of James Fenn he was transferred to the care of his brother Thomas Fenn, at another farm-house in this parish called Broadway, where he lived with the several successive tenants of that farm, and with the same provision allowed by government, to the time of his death, Feb. 22. 1785, when he was supposed to be about 72 years of age.

"Peter was well made, and of the middle size. His countenance had not the appearance of an idiot, nor was there any thing particular in his form, except that two of the fingers of his left hand were united by a web up to the middle joint. He had a natural ear for music, and was so delighted with it, that if he heard any musical instrument played upon, he would immediately dance and caper about till he was almost quite exhausted with fatigue; and though he could never be taught the distinct utterance of any word, yet he could easily learn to hum a tune. All those idle tales which have been published to the world about his climbing up trees like a squirrel, running upon all fours like a wild beast, &c. are entirely without foundation; for he was so exceedingly timid and gentle in his nature, that he would suffer himself to be governed by a child. There have been also many false stories propagated of his incontinence; but from the minutest inquiries among those who constantly lived with him, it does not appear that he ever discovered any natural passion for women, though he was subject to the other passions of human nature, such as anger, joy, &c. Upon the approach of bad weather he always appeared sullen and uneasy. At particular seasons of the year he showed a strange fondness for stealing away into the woods, where he would feed eagerly upon leaves, beech-mast, acorns, and the green bark of trees, which proves evidently that he had subsisted in that manner for a considerable length of time before he was first taken. His keeper therefore at such seasons generally kept a strict eye over him, and sometimes even confined him, because if he ever rambled to any distance from his home he could not find his way back again: and once in particular, having gone beyond his knowledge, he wandered as far as Norfolk, where he was taken up, and being carried before a magistrate, was committed to the house of correction in Norwich, and punished as a sturdy and obstinate vagrant, who would not (for indeed he could not) give any account of himself: but Mr Fenn having advertised him in the public papers, he was released from his confinement, and brought back to his usual place of abode.

"Notwithstanding the extraordinary and savage state in which Peter was first found greatly excited the attention and curiosity of the public; yet, after all that has been said of him, he was certainly nothing more than a common idiot without the appearance of one. But as men of some eminence in the literary world have in their works published strange opinions and ill-founded conjectures about him, which may seem to stamp a credit upon what they have advanced; that posterity may not through their authority be hereafter misled upon the subject, this short and true account of Peter is recorded in the parish-register by one who constantly resided above 30 years in his neighbourhood, and had daily opportunities of seeing and observing him."

Perhaps our readers will not be displeased if we present them with Lord Monboddo's account of this extraordinary creature (A). "It was in the beginning of June 1782 (says his lordship) that I saw him in a farm-house called Broadway, within about a mile of Berkhamstead, kept there upon a pension which the king pays. He is but low of stature, not exceeding five feet three inches; and although he must now be about 70 years of age, has a fresh healthy look. He wears his beard; his face is not at all ugly or disagreeable; and he has a look that may be called sensible and sagacious for a savage. About 20 years ago he was in use to elope, and to be missing for several days; and once, I was told, he wandered as far as Norfolk; but of late he has been quite tame, and either keeps in the house or saunters about the farm. He has been the 13 last years where he lives at present; and before that he was 12 years with another farmer, whom I saw and conversed with. This farmer told me, that he had been put to school somewhere in Hertfordshire, but had only learned to articulate his own name Peter, and the name of King George, both which I heard him pronounce very distinctly. But the woman of the house where he now is (for the man happened not to be at home) told me, that he understood every thing that was said to him concerning the common affairs of life; and I saw that he readily understood several things that she said to him while I was present. Among other things she desired him to sing Nancy Dawson; which he did, and another tune which she named. He never was mischievous, but had always that gentleness of nature which I hold to be characteristical of our nature, at least till we became carnivorous, and hunters or warriors. He feeds at present as the farmer and his wife do; but, as I was told by an old woman (one Mrs Collop, living at a village in the neighbourhood called Hempstead, who remembered to have seen him when he first came to Hertfordshire, which she computed to be 55 years before the time I saw her), he then fed very much upon leaves, and particularly upon the leaves of cabbage, which he ate raw. He was then, as she thought, about 15 years of age, walked upright, but could climb trees like a squirrel. At present he not only eats flesh, but has also got the taste of beer, and even of spirits, of which he inclines to drink more than he can get. And the old farmer above mentioned, with whom he lived twelve years before he came to this last farmer, told me, that he had acquired that taste before he came to him, which is about 25 years ago. He has also become very fond of fire, but has not yet acquired a liking for money; for though he takes it, he does not keep it, but gives it to his landlord or landlady, which I suppose is a lesson that they have taught him. He retains so

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(A) This eccentric writer, in support of his hypothesis, that man in a state of nature is a mere animal, without clothes, houses, the use of fire, or even speech, adduces the oran-outang, or man in the woods, and this Peter the wild man and others, as examples. He denies the want of the organs of speech as an objection, and insists they only want the artificial use of them.

much of his natural instinct, that he has a fore-feeling of bad weather, growling and howling, and showing great disorder, before it comes.

"These are the particulars concerning him which I observed myself, or could learn by information from the neighbourhood." From all these facts put together his lordship makes the following observations:

"1st, Whatever doubts there may be concerning the humanity of the oran-outang, it was never made a question but that Peter was a man.

"2dly, That he was, as the Dean [Swift] says, of a father and mother like one of us. This, as I have said, was the case of two savages found in the Dismal swamp in Virginia, of the one found in the island of Diego Garcia, and of him that was discovered by M. le Roy in the Pyrenees, and in general of all the savages that have been found in Europe within these last 300 years; for I do not believe, that for these 2000 years past there has been a race of such savages in Europe.

"3dly, I think there can be no reason to doubt of what was written from Hanover, and published in the newspapers, that he was found going upon all fours, as well as other solitary savages that have been found in Europe. It is true that others have been found erect; which was the case of the two found in the Dismal swamp of Virginia, likewise of the man of the Pyrenees, and of him in the island of Diego Garcia; but these I suppose were not exposed till they had learned to walk upright; whereas Peter appears to have been abandoned by his parents before he had learned that lesson, but walked as we know children do at first.

"4thly, I think it is evident that he is not an idiot, not only from his appearance, as I have described it, and from his actions, but from all the accounts that we have of him, both those printed and those attested by persons yet living; for as to the printed accounts, there is not the least information of that kind in any of them, except in one, viz. Wye's letter, N° 8. wherein is said, that some imputed his not learning to speak to want of understanding; which I should think showed rather want of understanding in those who thought so, when it is considered that at this time he had not been a year out of the woods, and I suppose but a month or two under the care of Dr Arbuthnot, who had taken the charge of his education. The Dean indeed tells us, that he suspected he was a pretender, and no genuine wild man, but not a word of his being an idiot. And as to the persons living, not one with whom I have conversed appeared to have the least suspicion of that kind; though it is natural that men who were not philosophers, and knew nothing of the progress of man from the mere animal to the intellectual creature, nor of the improvement of our understanding by social intercourse and the arts of life, but believed that man when he came to a certain age has from nature all the faculties which we see him exert, and particularly the faculty of speech, should think him an idiot, and wanting even the capacity of acquiring understanding. I knew an officer of dragoons, a man of very good sense, who was quartered where Peter then lived for some months, and saw him almost every day, and who assured me that he was not an idiot, but showed common understanding, which was all that could be expected from one no better educated than he.

"Lastly, those who have considered what I have said (B) of the difficulty of articulation, will not be surprised that a man who had lived a savage for the first 14 or 15 years of his life, should have made so little progress in that art. I cannot, however, have the least doubt, that if he had been under the care of Mr Braidwood of Edinburgh, he would have learned to speak, though with much more difficulty than a man who had been brought up tame among people who had the use of speech, and who consequently must know the advantage of it. And I can have as little doubt that Mr Braidwood could have taught the oran-outang in Sir Ashton Lever's collection, who learned to articulate a few words, so as to speak plainly enough."

St PETER *Le Port*, a market town of England, in the south-east part of Guernsey, in Hampshire, in the British channel, consisting of only one long and narrow street. The mouth of the harbour is well set with rocks, and is on each side defended by a castle; one called the *Old castle*, and the other *Castle-cornet*. The governor of the island generally resides here, who has the command of the garrison in this and all the other castles. The harbour has a good road, from whence ships may sail with any wind, and from the road pass under the guns of the castle to the pier, close up to the town. The pier is a noble work, formed of vast stones, joined together with great art and regularity; it is not only a security to the ships, but, being contiguous to the town, is handsomely paved at the top with large smooth flagstones, guarded with parapets, and, being of a great length and breadth, forms a pleasant walk, affording a free prospect of the sea and the neighbouring islands. Cornet-castle, which commands both the town and the harbour, stands on a rock, separated from the land by an arm of the sea, no less than 600 yards wide, and not fordable but at low water in great spring-tides.

St PETER's *island*, in the lake of Bienne in Switzerland, remarkable for being one of the retreats of Rousseau; whence it has also got the name of *Rousseau's island*. It lies towards the south side of the lake, and produces a great variety of shrubs and trees, particularly large oaks, beech, and Spanish chesnut. The southern shore slopes gradually to the lake, and is covered with herbage; the remaining borders are steep and rocky; their summits in a few places thinly covered with shrubs; in others their perpendicular sides are clothed to the water's edge with hanging woods. The views from the different parts of the island are beautiful and diversified; that to the north being the most extensive and pleasing. It commands the prospect of the lake, which is of an oval form; its cultivated borders, interspersed with villages and castles, with the towns of Nidau and Bienne standing upon the farther extremity. Agreeable walks are carried through the woods, and terminate in a circular pavilion placed in the centre of the island. Before the troubles in France, on Sunday, and particularly the vintage-time, this island was filled with

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(B) Lord Monboddo, far from thinking speech or articulation natural to man, rather wonders how he can by any teaching or imitation attain to the ready performance of such various and complicated operations. Add to this, when the organs are completely formed to one language, how hard it is to make them answer another.

with parties who amused themselves with wandering about the woods or dancing in the circular pavilion. How they employ themselves now it is not so easy to say, as it was overrun and subjected by the forces of that unhappy nation, and of course tainted with their destructive principles. It was retaken by the Spaniards, and properly belongs to the king of Sardinia. There is only one farm-house on the island, in an apartment of which Rousseau was lodged.

Peter-Pence, was an annual tribute of one penny, paid at Rome out of every family at the feast of St Peter. And this Ina the Saxon king, when he went in pilgrimage to Rome about the year 740, gave to the pope, partly as alms and partly in recompense of a house erected in Rome for English pilgrims. And this continued to be paid generally until the time of King Henry VIII. when it was enacted, that from henceforth no person shall pay any pensions, Peter-pence, or other impositions, to the use of the bishop or see of Rome.

PETERBOROUGH, a city of Northamptonshire, about 82 miles from London. It is the least city except perhaps Ely, and unquestionably the poorest bishopric, though one of the oldest towns in England. It had a monastery dedicated to St Peter, and founded as early as the year 655, to which the abbot of Croyland and his monks flying for protection in the year 870, they were overtaken and murdered in a court of this monastery, called the *monks churchyard*, because they were all buried here; and to this day is to be seen the tombstone with their effigies, which had been erected over their common grave. Soon after this the Danes destroyed both the monastery and friars, so that it lay destitute for above 100 years. The monks were, however, restored, and lived very sumptuously, with a mitred abbot at their head, till the reformation, when Henry VIII. converted it into a bishop's see. The cathedral, which is said to be more than 1000 years old, though apparently more modern, is a most noble Gothic fabric, and was much more so before it was defaced in the civil wars. The west front, which is 156 feet broad, is very stately; and besides columns curiously adorned, is supported by three of the tallest arches in Britain. The windows of the cloisters are finely stained with scripture history and the succession of its abbots. There are in the church, monuments of Queen Catherine, wife of Henry VIII. and of Mary queen of Scots; and the figure of one Mr Scarlet the sexton, who buried them, and lived to 95, after he had buried all the housekeepers of the town twice over. There is but one parish-church besides the cathedral. The city is governed by a mayor, recorder, and aldermen, by a charter of Henry VIII. All its officers are elected by the dean and chapter, consisting of six prebendaries, who are all lords of the manor. Besides the dean and chapter, who are an ecclesiastical corporation distinct from the bishop, there are eight petty canons, four students in divinity, one epistler, one gospeller, a subdean, subtreasurer, and chanter, eight choristers, eight singing men, two chancellors, besides a steward, organist, &c. a grammar school, and two charity schools. The river Nen, over which there is here a wooden bridge, is navigable by barges to Northampton, 50 miles further, which bring coal, corn, &c. and by which they export in some years 6000 quarters of malt, besides other goods, especially the woollen manufactures either of cloth or stockings, in which the poor are employed. The air of Peterborough is said not to be very wholesome, by reason of the neighbouring fens; but the water of the river is good, the highest spring-tide never coming up within five miles of the town; and there is excellent water in their wells. The streets are poor, and the houses but mean; there is, however, a handsome market-house, over which are kept the assizes and sessions. Its jurisdiction extends over 32 towns and hamlets, wherein the civil magistrates appointed by the royal commission are vested with the same power as judges of assize, and hold their quarterly sessions in this city. The number of inhabitants in 1801 was 3449, and in 1811, 3674.

PETERHEAD, a town in Scotland, in the county of Aberdeen, lies about 30 miles north-east of that city. It stands on the most easterly point in Scotland, and from thence due west that kingdom is broadest.

Peterhead is the nearest land to the northern continent of Europe, and lies within 300 miles of the *cape*, which is called the *Naze of Norway*. Through this channel the grand body of the herrings pass in their annual migrations from Shetland and the north seas to the more southern latitudes, attended with the all-devouring cod and ling; on which account Peterhead, or, as it is sometimes called, *Buchanness*, hath always been the second station of the Dutch busses after leaving the Shetland islands. Tradition says, that some hundred years ago the Dutch offered Lord Mareschal, then the proprietor of the coast, to cover a small island called *Inch-Keith* with silver for the property of it to carry on their fisheries, which for obvious reasons could not be accepted. Be that as it may, the Dutch, in time of peace, still frequent the coast in July and August, and sometimes 100 sail are seen within sight of land, busily employed in the herring and white fisheries. The natives, to whom this treasure properly belongs, have lately made some attempts towards the white fishery, of which they cure and vend, chiefly at the London market, 4000 barrels of delicate small cod and ling annually. They also fit out some vessels for the Hebride fishery off Barrahead for the Barcelona market; and they claim the merit of having taught the islanders how to take and cure the large fish which abound on their coasts. They have often gained the highest premiums allowed by government for curing white fishes.

Few harbours in Great Britain are of more importance to navigation than this of Peterhead, as, in case of violent storms from the easterly points, large vessels embayed betwixt this and the mouth of the Forth have not a port that they can safely take at every time of the tide, that of Aberdeen excepted. If therefore they cannot make their way to sea in the teeth of a strong easterly wind, or double this headland that they may gain the Murray frith, they must inevitably come on shore. This harbour lies on a spacious bay, where vessels of any burden may ride in all other winds, and is therefore the general rendezvous of the shipping which frequent the northern seas, where they cast anchor on clean ground, and ride safely till the storms have abated. But though nature hath done so much for the benefit of navigation, something is left for the exercise of human aid. The harbour can at present contain in perfect safety 40 or 50 sail of vessels drawing 12 feet water, and is capable of being extended so as to admit a greater number of ships drawing 20 feet: by which means not only casual merchantmen but small ships of war with their convoys would find this a most desirable refuge when pursued by superior force. The harbour is defended by a good battery. A considerable trade is carried on from this place directly to the Baltic for deals, iron, hemp, tar, and other articles. There is also a manufacture of sewing thread, which employs many young girls. A mineral well in the summer-months gives great gaiety to the place; its salutary virtues have long, and we believe very justly, been celebrated. The waters of this spring are powerfully diuretic, and are thought to be efficacious in removing complaints in the bowels.

Twelve pounds avoirdupois of this water were analysed by Dr Laing, who found it composed of

Muriate of iron,	30.75 grains.
Carbonate of iron,	3.25
Muriate of lime,	7.00
Siliceous earth,	2.00
Sulphate of lime,	2.00
———— soda,	13.25
Muriate of soda,	7.5

Carbonic acid gas, 83.5 cubic inches. The ingenious author of the above analysis recommends this water very much in cases of scrofula. Its most valuable property is tonic, which is no doubt derived from the iron that enters into its composition.

There are here many elegant houses for the accommodation of strangers. There is also a ball-room, under which there are two salt-water baths. These baths are much frequented in nervous disorders: their effect in strengthening the constitution is often surprising. Owing to the open peninsulated situation, the air of this place is esteemed peculiarly pure and healthful; even the fogs rising from the sea are thought to be medicinal: the town is therefore much enlivened by the concourse of company who frequent it on these accounts. Upon the whole, the town is neat and well built, the houses are handsome, and the streets tolerably spacious and very clean; and has every appearance of a thriving and plentiful place. In 1793, the population was 4100, being 1613 greater than in 1755; in 1801, the numbers had increased to 4491, and in 1811 to 4707.

PETERHOFF, in Russia, is situated about 20 miles from Petersburgh, and is distinguished for its palace and gardens. The palace was begun by Peter I. and finished by Elizabeth. As it is placed upon an eminence, it commands a most superb view of Cronstadt, Petersburg, the intervening gulf, and the opposite coast of Carelia. The palace is most magnificently furnished, and the suite of apartments are truly princely. The presence-chamber is richly ornamented with portraits of the sovereigns of the house of Romanof, who have reigned in Russia since 1613.

Coxe's Travels, vol. i. p. 485.

"The gardens of Peterhoff (says an intelligent traveller) have been celebrated for their taste and elegance; and from the number of jet d'eaus, fountains, basons, cascades, parterres, &c. they have been compared to those of Versailles: and indeed in one respect they are far superior; for the water-works of the latter only play upon particular occasions, while those of Peterhoff are perennial. These gardens, which at the time of their formation were greatly admired in this country, though not congenial to the taste of the empress, are suffered to remain in their present state; as during summer her majesty principally resides at Tzarskoe-Selo, where the grounds are disposed in a more modern and pleasing manner." A vast number of silver dolphins and gilded statues are scattered through them; but the most remarkable figures are those of two gladiators placed in a bason of water. These are represented, not with the sword and buckler, the ancient implements of war, but with a brace of pistols. These they point to each other in a threatening posture, while the water gushes impetuously from the barrels. In that part of the garden which lies between the palace and the gulf, close to the water, is a building which was the favourite retreat of Peter I. It is preserved, together with its furniture, entirely in its original state, with a kind of religious veneration. Its plainness shows the frugal simplicity in which that monarch was accustomed to live. In the same celebrated gardens there is a remarkable building called the *mountain for sledges*, and often by travellers the *flying mountain*. "It stands (says Mr Coxe) in the middle of an oblong area, inclosed by an open colonnade, with a flat roof, which is railed for the convenience of holding spectators. The circumference of this colonnade is at least half a mile. In the middle of the area stands the flying mountain, stretching nearly from one end to the other. It is a wooden building, supported upon pillars, representing an uneven surface of ground, or a mountain composed of three principal ascents, gradually diminishing in height, with an intermediate space to resemble valleys: from top to bottom is a floored way, in which three parallel grooves are formed. It is thus used: a small carriage containing one person being placed in the centre groove upon the highest point, goes with great rapidity down one hill; the velocity which it acquires in its descent carries it up a second; and it continues to move in a similar manner until it arrives at the bottom of the area, where it rolls for a considerable way on the level surface, and stops before it attains the boundary: it is then placed in one of the side grooves, and drawn up by means of a cord fixed to a windlass. To a person unacquainted with the mechanism, this entertainment would appear tremendous; but as the grooves always keep the carriage in its right direction, there is not the least danger of being overturned. At the top of the mountain is a handsome apartment for the accommodation of the court and principal nobility; there is also room for many thousand spectators within the colonnade and upon its roof. Near the flying mountain is a spacious amphitheatre, in which tournaments are usually exhibited."

PETERS, Father, a Jesuit, was confessor and counsellor to James II. king of England. This prince dismissed him in 1688, because he was considered as the author of those troubles in which the kingdom was then involved. "He was (says Bishop Burnet) the most violent of the king's advisers, and the person most listened to. Though he had the honour of being nobly descended, he was a man of no extensive erudition, and was eminent only for his bigotry and forwardness." Though Burnet is not always to be believed, yet certain it is, from the testimony of other historians, that Father Peters was by no means a person properly qualified to direct King James in the critical situation in which he then stood.

PETERSBURGH, St, a city in Russia, and capital of a province of the same name, and of the whole empire. It is situated in N. Lat. 59. 26. 23. and E.

Long. 30. 25. and contains about 260,000 inhabitants. It was founded in the year 1703 by Czar Peter the Great, whose ambition it was to have a fleet on the Baltic; for which reason he determined to found a city which might become the centre of trade throughout all his dominions. The spot he pitched upon was a low, fenny, uncultivated island, formed by the branches of the river Neva, before they fall into the gulf of Finland. In the summer this island was covered with mud; and in winter became a frozen pool, rendered almost inaccessible by dreary forests and deep morasses, the haunts of bears, wolves, and other savage animals. Having taken the fort of Nattebourg, and the town of Neischanz, in the year 1703, this mighty conqueror assembled in Ingria above 300,000 men, Russians, Tartars, Cossacks, Livonians, and others, even from the most distant parts of his empire, and laid the foundation of the citadel and fortifications, which were finished in four months, almost in despite of nature. He was obliged to open ways through forests, drain bogs, raise dykes, and lay causeways, before he could pretend to found the new city. The workmen were ill provided with necessary tools and implements, such as spades, pick-axes, shovels, planks, and wheel-barrows: they were even obliged to fetch the earth from a great distance in the skirts of their garments, or in little bags made of old mats and rags sewed together. They had neither huts or houses to shelter them from the severity of the weather: the country, which had been desolated by war, could not accommodate such a multitude with provisions; and the supplies by the lake Ladoga were often retarded by contrary winds. In consequence of these hardships, above 100,000 men are said to have perished: nevertheless the work proceeded with incredible vigour and expedition; while Peter, for the security of his workmen, formed a great camp, in such a manner, that his infantry continued in Finland, and his cavalry were quartered in Ingria. Some Swedish cruizers being descried in the neighbourhood, the czar posted a body of troops in the isle of Rutzari, by whom the Swedes were repulsed, and the work met with no farther interruption. The buildings of the city kept pace with the fortress, which is the centre of the town, surrounded on all sides by the Neva; and in little more than a year, above 30,000 houses were erected. At present there may be about double that number in Petersburg, though many of them are paultry and inconsiderable. In order to people this city, Peter invited hither merchants, artificers, mechanics, and seamen, from all the different countries of Europe: he demolished the town of Nieuschants, and brought hither not only the materials of the houses, but the inhabitants themselves. A thousand families were drawn from Moscow; he obliged his nobility to quit their palaces and their villas in and about Moscow, and take up their residence at Petersburg, in a much more cold and comfortless climate. Finally, resolving to remove hither the trade of Archangel, he issued an ordonnance, importing, that all such merchandise as had been conveyed to Archangel, in order to be sold to foreigners, should now be sent to Petersburg, where they should pay no more than the usual duties. These endeavours and regulations have rendered this one of the greatest and most flourishing cities in Europe. The Russian boyars and nobility have built magnificent palaces, and are now reconciled to their situation. At first many houses were built of timber; but these being subject to sudden conflagrations in spite of all the precautions that could be taken, the czar, in the year 1714, issued an order, that all new houses should be walled with brick and covered with tiles. The fort is an irregular hexagon, with opposite bastions. This, together with all the rest of the fortifications, was in the beginning formed of earth only; but in the sequel they were faced with strong walls, and provided with casemates, which are bomb-proof. In the curtain of the fort, on the right hand side, is a noble dispensary, well supplied with excellent medicines, and enriched with a great number of porcelain vases from China and Japan. From one of the gates of the fort a draw-bridge is thrown over an arm of the river, in which the czar's galleys and other small vessels are sheltered in the winter. The most remarkable building within the fort is the cathedral, built by the direction of an Italian architect. Petersburg is partly built on little islands, some of which are connected by draw-bridges; and partly on the continent. In the highest part, on the bank of the Neva, the czar fixed his habitation, or ordinary residence, built of freestone, and situated so as to command a prospect of the greater part of the city. Here likewise is a royal foundery; together with the superb houses of many noblemen. The marshy ground on which the city is built, being found extremely slippery, dirty, and incommodious, the czar ordered every inhabitant to pave a certain space before his own door. In the year 1716, Peter, taking a fancy to the island Wasili-Osterno, which he had given as a present to Prince Menzikoff, resumed the grant, and ordered the city to be extended into this quarter. He even obliged the boyars, or nobles, to build stone houses on this spot, though they were already in possession of others on the side of Ingria: accordingly this is now the most magnificent part of the city. On the other side of a branch of the Neva stands the czar's country or summer palace, provided with a fine garden and orangery. On the bank of the same river is the sloboda, or suburbs, in which the Germans generally choose their habitation. Petersburg is very much subject to dangerous inundations. In the year 1715, all the bastions and draw-bridges were either overwhelmed or carried away. The breadth, depth, and rapidity of the Neva, have rendered it extremely difficult, if not impracticable, to join the islands and the continent by bridges. Besides, Peter was averse to this expedient for another reason; resolved to accustom his subjects to navigation, he not only rejected the project of a bridge, but also ordered that no boat should pass between the islands and continent, except by the help of sails only. In consequence of this strange regulation, many lives were lost: but at length he gained his point; and by habituating his sluggish Muscovites to the dangers of the sea, in a little time produced a breed of hardy sailors. The adjacent country is so barren, that the town must be supplied with provisions from a great distance; consequently they are extremely dear. Here are woods in plenty, consisting of pine, fir, alder, birch, poplar, and elm; but the oak and the beech are generally brought from Casan. In winter the weather is extremely cold, and hot in the summer. In June the length of the night does not exceed three hours, during which the natives enjoy a continued twilight: but in December the sun is not visible more than three hours above the horizon.

The czar Peter, who was indefatigable in his endeavours to improve and civilize his subjects, neglected nothing which he thought could contribute to these purposes. He condescended even to institute and regulate assemblies at Petersburg: these were opened at five in the afternoon, and the house was shut at ten: between these hours the fashionable people of both sexes met without ceremony, danced, conversed, or played either at cards or at chess, this last being a favourite diversion among the Russians. There was likewise an apartment appointed for drinking brandy, and smoking tobacco. Plays and operas were likewise introduced for the same purposes; but as Peter had little relish, and less taste, for those entertainments, they were performed in a very awkward manner in his lifetime: however, since his death these performances have been brought to a greater degree of art and decorum.

This great northern legislator established, in the neighbourhood of Petersburg, manufactures of linen, paper, saltpetre, sulphur, gunpowder, and bricks, together with water-mills for sawing timber. He instituted a marine academy, and obliged every considerable family in Russia, to send at least one son or kinsman, between the ages of ten and eighteen, to this seminary, where he was instructed in navigation, learned the languages, was taught to perform his exercises, and to live under the severest discipline. To crown his other plans of reformation, he granted letters patent for founding an academy, upon a very liberal endowment; and though he did not live to execute this scheme, his empress, who survived him, brought it to perfection.

Peter the great has been much censured for transferring the seat of the empire from Moscow to St Petersburg; the former of which lay nearer to the centre of his dominions. But these objections will have but little weight with those who consider the consequences of the removal. The new city is nearer than Moscow was to the more civilized parts of Europe; and from an intercourse with them the manners of the Russians have been improved, and the nobility in particular have lost much of their feudal importance. Above all, the grand object of Peter, that of having a formidable navy in the Baltic has certainly been obtained, and the empress of Russia is now the arbitress of the north, and in some degree the mediatrix of all Europe. In short, the erection of St Petersburg was perhaps one of the best acts of Peter's reign, and has in its consequences been the most beneficial. Indeed it is at least probable, that if through any revolution the seat of government should be again transferred to Moscow, we should nowhere see the traces of these memorable improvements, which the passing century has given birth to, but in the annals of history; and Russia would again, in all probability, relapse into her original barbarism.

The erection of such a city as Petersburg in so short a time is truly wonderful. Mr Coxe says his mind was filled with astonishment, when he reflected that so late as the beginning of the 18th century, the ground on which it stands was one vast morass, occupied by a very few fishermen's huts. The present divisions of the town, some of which we have already mentioned, are called, 1. The Admiralty quarter; 2. The Vassili Ostrof or Island; 3. The Fortress; 4. The island of St Petersburg; and, 5. The various suburbs of Livonia, of Moscow, of Alexander Nevski, and of Wiburg.

The late empress has done so much for this city, that she may not improperly be called its second foundress. It is nevertheless, still an infant place, and, as Mr Wraxall observes, 'only an immense outline which will require future empresses, and almost future ages, to complete."

Coxe's Travels.

"The streets in general, says a late traveller, are broad and spacious; and three of the principal ones, which meet in a point at the admiralty, and reach to the extremities of the suburbs, are at least two miles in length. Most of them are paved; but a few are still suffered to remain floored with flanks. In several parts of the metropolis, particularly in the Vassili Ostrof, wooden houses and habitations, scarcely superior to common cottages, are blended with the public buildings; but this motley mixture is far less common than at Moscow, where alone can be formed any idea of an ancient Russian city. The brick houses are ornamented with a white stucco, which has led several travellers to say that they are built with stone; whereas, unless I am greatly mistaken, there are only two stone structures in all Petersburg. The one is a palace, building by the empress upon the banks of the Neva, called *the marble palace;* it is of hewn granite, with marble columns and ornaments; the other is the church of St Isaac, constructed with the same materials, but not yet finished.

"The mansions of the nobility are many of them vast piles of building, but are not in general upon so large and magnificent a scale as several I observed at Moscow: they are furnished with great cost, and in the same elegant style as at Paris or London. They are situated chiefly on the south side of the Neva, either in the Admiralty quarter, or in the suburbs of Livonia and Moscow, which are the finest parts of the city." See NEVA.

"Petersburg, although it is more compact than the other Russian cities, and has the houses in many streets contiguous to each other, yet still bears a resemblance to the towns of this country, and is built in a very straggling manner. By an order issued many years ago by the government, the city was inclosed within a rampart, the circumference whereof is 21 versts, or 14 English miles."

The public hospital is under an admirable system of management, both with regard to the cleanliness and comfort of the inmates. The revenues arise from the surplus profit of the Lombard bank, and amount to about 120,000 roubles per annum; by which provision is made for upwards of 200 people in the house, and assistance given to 15,000 out patients.

The Foundling Hospital, though inferior in magnitude to that of Moscow, had 6000 children on its lists in 1813, of whom 600 were kept within the house. The expense incurred for the whole is 40,000 roubles per annum. The children upon being sent here are immediately vaccinated, and when recovered, placed out with different families to nurse, till the period of their education commences. They are next selected, according to their natural talent, for the several employments, liberal or mechanical, to which they seem most inclined, and are brought up accordingly under excellent preceptors. Some are sent to the manufactories; some to the military schools, and others kept at home, and instructed in the arts or the belles lettres.

The fashionable promenade of the *boulevards* consists of three avenues of trees carried round three sides of the admiralty, a building which exhibits perhaps the longest regular façade in Europe: it is upwards of a quarter of an English mile in extent, adorned at intervals with six several porticoes, and surmounted rather fantastically, with a thin taper dome and spire.

The academy of arts is zealously patronised by the government; and from the revenues allotted to it, is well furnished with models from the antique, as well as other matters suited to the institution. The labours of the students exhibit some of the highest specimens of imitative excellence. Their designs in architecture are of great merit, and their pictures possess a free style of execution, combined with chasteness and harmony of colouring, seldom equalled in any modern school.

The mint is a pretty large establishment, furnished with a very complete coining apparatus, exactly similar to that employed in London, and made in England by Messrs Watt and Bolton. The labourers are all peasants, and receive merely soldiers pay. They are daily stript to the skin, and so narrowly searched, that even the cunning of a Russian cannot find a secure mode of peculation. From excessive issues the paper money has long been very low in value. In 1814, according to Mr James, the paper rouble was worth only 10½d. instead of 3s. 4d.

Of the edifices lately erected in Petersburg, the cathedral church of the virgin of Casan is the most magnificent. It was opened in 1814, having been 15 years in building, and cost no less than 15,000,000 of roubles. The plan was furnished by Worowitchki, a Russian slave, educated at the imperial academy under the patronage of his master Count Strogonov. He displayed an extraordinary genius for architecture, and not only planned the cathedral, but superintended the execution of the work. He just lived to see it finished. The building is in the form of a cross with a cupola in the in the centre; each arm of the cross terminates with a Corinthian portico; and that in the front is received into a grand semicircular colonnade four columns in depth. The arc of this colonnade was intended to have been ornamented with the statues of St Peter and St Paul, raised on gigantic blocks of solid granite ten or twelve feet high, but this has not yet been accomplished. The design is thought to be wanting in harmony; but the decorations are chaste, and the effect of the whole is noble and imposing in a very high degree.

Education among the higher classes of the male sex is very much neglected. The tutorage of a French abbé at home, and a short residence at one of the universities, is the only chance given to the son of a man of consequence for pursuing the belles lettres, or for acquiring any other knowledge than such as may be picked up in society. But the professional education of those who are destined for the civil, military or commercial line is much better. Girls are brought up with a degree of attention proportionate to the neglect with which the other sex is treated. The *Couvent de Demoiselles*, and the Institute of Catherine, both flourishing under the patronage and perpetual inspection of the empress dowager, are the chief seminaries for females at Petersburg. Notwithstanding the timidity of the female character, a public examination is held every three years, and rewards are bestowed on those who have made the greatest progress. The convent contains two separate establishments, one for the education of 260 girls, the daughters of the burgeois, the other for those of the class of nobility. The period of education is about nine years, during which they receive instruction in the French, German, and Russian languages, in the Russian history, in natural philosophy, music, dancing, embroidery, writing, arithmetic, and *geometry*.

There are various manufactures in the city or neighbourhood conducted by the government. There is a cotton manufactory on the Neva, for which 600 boys and girls are furnished from the Foundling hospital. There is an imperial plate glass manufactory worked by the emperors slaves; an extensive cloth manufactory; a porcelain manufactory, and several others. It is believed that the government loses considerably by these establishments, but they are supported with the view of naturalizing these species of industry.

The trade of Petersburg is extensive. The number of ships entered at the port in 1813, was 690, of which 343 were British.

We have already said that Petersburg is very liable to be inundated. An inundation of a very alarming nature took place when Mr Coxe was there in September 1777, of which the following account was given in Journal St Petersburg, September 1777: "In the evening of the 9th, a violent storm of wind blowing at first S. W. and afterwards W. raised the Neva, and its various branches to so great a height, that at five in the morning the waters poured over their banks, and suddenly overflowed the town, but more particularly the Vassili Ostrof and the island of St Petersburg. The torrent rose in several streets to the depth of four feet and a half, and overturned, by its rapidity, various buildings and bridges. About seven, the wind shifting to N. W. the flood fell as suddenly; and at midday most of the streets, which in the morning could only be passed in boats, became dry. For a short time, the river rose 10 feet 7 inches above its ordinary level."

All our readers have unquestionably heard of the equestrian statue of Peter I. in bronze. We shall give an account of that extraordinary monument in Mr Coxe's own words. "It is (says he) of a colossal size, and is the work of Monsieur Falconet, the celebrated French statuary, cast at the expence of Catherine II. in honour of her great predecessor, whom she reveres and imitates. It represents that monarch in the attitude of mounting a precipice, the summit of which he has nearly attained. He appears crowned with laurel, in a loose Asiatic vest, and sitting on a housing of bearskin: his right hand is stretched out as in the act of giving benediction to his people; and his left holds the reins. The design is masterly, and the attitude is bold and spirited. If there be any defect in the figure, it consists in the flat position of the right hand; and for this reason, the view of the left side is the most striking, where the whole appearance is graceful and animated. The horse is rearing upon its hind legs; and its tail, which is full and flowing, slightly touches a bronze serpent, artfully contrived to assist in supporting the vast weight.

weight of the statue in due equilibrium. The artist has, in this noble essay of his genius, represented Peter as the legislator of his country, without any allusion to conquest and bloodshed; wisely preferring his civil qualities to his military exploits. The contrast between the composed tranquillity of Peter (though perhaps not absolutely characteristic) and the fire of the horse, eager to press forwards, is very striking. The simplicity of the inscription corresponds to the sublimity of the design, and is far preferable to a pompous detail of exalted virtues, which the voice of flattery applies to every sovereign without distinction. It is elegantly finished in brass characters, on one side in Latin, and on the opposite in Russian. *Petro primo Catharina secunda*, 1782; i. e. Catherine II. to Peter I.

"The statue, when I was at Petersburg, was not erected, but stood under a large wooden shed near the Neva, within a few yards of its enormous pedestal. When Falconet had conceived the design of his statue, the base of which was to be formed by a huge rock, he carefully examined the environs of Petersburg, if, among the detached pieces of granite which are scattered about these parts, one could be found of magnitude correspondent to the dimensions of the equestrian figure. After considerable research, he discovered a stupendous mass half buried in the midst of a morass. The expence and difficulty of transporting it were no obstacles to Catherine II. By her order the morass was immediately drained, a road was cut through a forest, and carried over the marshy ground; and the stone which, after it had been somewhat reduced, weighed at least 1500 tons, was removed to Petersburg. This more than Roman work was, in less than six months from the time of its first discovery, accomplished by a windlass, and by means of large friction balls alternately placed and removed in grooves fixed on each side of the road. In this manner it was drawn, with 40 men seated upon its top, about four miles, to the banks of the Neva; there it was embarked in a vessel constructed on purpose to receive it, and thus conveyed about the same distance by water to the spot where it now stands. When landed at Petersburg, it was 42 feet long at the base, 36 at the top, 21 thick, and 17 high; a bulk greatly surpassing in weight the most boasted monuments of Roman grandeur, which, according to the fond admirers of antiquity, would have baffled the skill of modern mechanics, and were alone sufficient to render conspicuous the reign of the most degenerate emperors.

"The pedestal, however, though still of prodigious magnitude, is far from retaining its original dimensions, as, in order to form a proper station for the statue, and to represent an ascent, the summit whereof the horse is endeavouring to attain, its bulk has been necessarily diminished. But I could not observe, without regret, that the artist has been desirous to improve upon nature: and, in order to produce a resemblance of an abrupt broken precipice, has been too lavish of the chissel.

"The statue was erected on the pedestal on the 27th of August 1782. The ceremony was performed with great solemnity, and was accompanied with a solemn inauguration. At the same time the empress issued a proclamation, in which, among other instances of her clemency, she pardons all criminals under sentence of death; all deserters who should return to their respective corps within a limited time; and releases all criminals condemned to hard labour, provided they had not been guilty of murder."

Mr Coxe informs us, that the weather is extremely changeable in this capital, and the cold is at times extreme; against which the inhabitants take care to provide (see PEASANT), though some of them nevertheless unfortunately fall victims to it. "As I traversed the city, (says Mr Coxe), on the morning of 12th January, I observed several persons whose faces had been bitten by the frost: their cheeks had large scars, and appeared as if they had been singed with an hot iron. As I was walking with an English gentleman, who, instead of a fur cap, had put on a common hat, his ears were suddenly frozen: he felt no pain, and would not have perceived it for some time, if a Russian, in passing by, had not informed him of it, and assisted him in rubbing the part affected with snow, by which means it was instantly recovered. This, or friction with flannels, is the usual remedy; but should the person in that state approach the fire, or dip the part in warm water, it immediately mortifies and drops off.—The common people continued at their work as usual, and the drivers plied in the streets with their sledges, seemingly unaffected by the frost; their beards were incrusted with clotted ice, and the horses were covered with isicles.

"It sometimes happens that coachmen or servants, while they are waiting for their masters, are frozen to death. In order to prevent as much as possible these dreadful accidents, great fires of whole trees, piled one upon another, are kindled in the court-yard of the palace and the most frequented parts of the town. As the flames blazed above the tops of the houses, and cast a glare to a considerable distance, I was frequently much amused by contemplating the picturesque groups of Russians, with their Asiatic dress and long beards, assembled round the fire. The centinels upon duty, having no beards, which are of great use to protect the glands of the throat, generally tie handkerchiefs under their chins, and cover their ears with small cases of flannel."

The police of this city has been much admired. This establishment consists of a police master, two presidents, the one for criminal, the other for civil cases, and two consulters, chosen from the burgher class. To this is committed the care to maintain decorum, good order and morals; the attainment of which is thus accomplished.

The residence is divided into ten departments, each of which has a president who must possess a correct knowledge of the inhabitants in his own department, of which he is regarded as the *censor morum*. His house must be a refuge both night and day for all in distress; and he must not leave the city for two hours under any pretext whatever, without appointing a substitute to act in his absence. The constables and watchmen of his department are subject to his orders; and in the discharge of his duty, he has two sergeants to attend him.

The night watchmen have stations assigned them, and are to be aided in the seizing of offenders, or in any service their commanders may require. There is also a command of 120 men, who are suported by a regiment of hussars, should the nature of their duty be at any time so hazardous as to render such a measure necessary.

This piece of political mechanism is so harmoniously connected in all its parts, that it becomes the admiration of every foreigner.

So extraordinary is the vigilance observed by every part of this admirable whole, that all secret inquisitions are totally superfluous. The police has a knowledge of every person in the residence; travellers are subject to certain formalities, in consequence of which to hide the place of their abode, or the time of their departure, are alike impracticable. Every householder must declare to the police who lodges with him, or what strangers have put up at his house. When travellers leave the town, they must publish in the newspapers their name, quality, and place of abode, three different times, and produce the papers containing such advertisement.

PETERSBURGH, in America, is a sea-port town in Virginia, 25 miles southward of Richmond, seated on both sides of the Appamatox river, about 12 miles above its junction with James river, and contained 5668 inhabitants in 1810. There is no regularity, and very little elegance in Petersburgh. It is merely a place of business. The Free Masons have a hall tolerably elegant; and the seat of the Bowling family is pleasant and well built. It is rather unhealthy. Like Richmond, Williamsburgh, Alexandria, and Norfolk, it is a corporation; and what is singular, Petersburgh city comprehends part of three counties. The celebrated Indian queen, Pocahonta, from whom descended the Randolph and Bowling families, formerly resided at this place. It is a place of considerable trade. Tobacco is the staple produce, of which above 20,000 hogsheads are annually received at the warehouses.

PETERSFIELD, a handsome town of Hampshire in England, and sends two members to parliament. It is seated in W. Long. 1. 5. N. Lat. 51. 5.

PETERWARADIN, a fortified town in Sclavonia, and one of the strongest frontier places the house of Austria has against the Turks, seated on the Danube between the Drave and the Save. E. Long. 20. 0. N. Lat. 45. 20.

PETIOLE, in *Botany*, the slender stalks that support the leaves of a plant.

PETIT, or PETITE, a French word signifying *little* or *small*.

PETITE Guerre, denotes the operations of detached parties and the war of posts. See WAR, Part III.

PETIT Sergeanty. See SERGEANTY.

PETIT Treason. See TREASON.

PETIT, *John*, a doctor of the Sorbonne, very early gained to himself a character by his knowledge, and those eloquent orations which he pronounced before the university of Paris. He was employed in the famous embassy which was sent from France to Rome, for the purpose of healing the schism in 1407; but he soon lost all the honour which he had acquired. John Sans Peur, duke of Burgundy, having treacherously contrived to assassinate Louis of France, duke of Orleans, only brother to Charles VI. John Petit, entirely devoted to the views of the murderer, maintained in a public disputation, at Paris, the 8th of March 1408, that the murder was lawful. He had the effrontery to assert, that "it is allowed to employ fraud, treason, and every other method, however base, in order to get rid of a tyrant; and that no faith ought to be kept with him." He dared to add further, that "the man who should commit such an action, not only deserved to be exempted from punishment, but to receive a reward." This sanguinary doctrine was loudly exclaimed against; but the duke of Burgundy's powerful influence sheltered Petit for some time. Some eminent writers, however, of that period, with Gerson at their head, denounced the doctrine to John de Montaigu, bishop of Paris, who condemned it as heretical the 23d November 1414. It was likewise condemned by the council of Constance the year following at the instigation of Gerson; but no notice was taken either of Petit's name or his writings. In fine, the king, on the 16th of September 1416, ordered the parliament of Paris to pronounce a severe decree against this dangerous performance; and it was also censured by the university. But the duke of Burgundy, in 1418, had interest enough to compel the grand vicars of the bishop of Paris, who then lay sick at St Omer's to retract the sentence which that prelate had past in 1414. Petit died three years before, i. e. in 1411, at Hesdin; and his apology in favour of the duke of Burgundy, with all the particulars of that infamous transaction, may be seen in the fifth volume of the last edition of Gerson's works. Father Pinchinat, of the order of St Francis, and author of the Dictionary of Heresies, in 4to, has endeavoured to vindicate his order from a charge brought by some writers, who have called Petit a *Cordelier*, or *Franciscan Friar*. "He proves very clearly (says Abbé Prevot) that he was a secular priest; and adds, that upon the same evidence, Father Mercier, a Cordelier, had a warm dispute in 1717 with M. Dupin, who had given this title to Petit in his Collection of Censures. He represented to him (says he), before a meeting of the Faculty, the falsity of such a claim, and the injury which he offered to the order of St Francis. Dupin, convinced of his error, candidly owned that he was led into it by following some infidel writers, and promised to retract it in the new edition of the Censures, which was published in 1720. M. Fleury, who had committed the same mistake, promised also to make amends for it by a solemn recantation; but dying before he had an opportunity of doing that piece of justice to the Cordeliers, the continuator of his Ecclesiastical History, who had not such opportunities of information, fell into the same fault." (*Pour & contre*, tom. x. p. 23.). If we take the opinion of L'Advocat's Dictionary, it would appear no fault was committed; for it gives a list of the pensioners of the dukes of Burgundy, in order to prove that John Petit was a Cordelier. Indeed, it is highly probable that if Dupin, Fleury, and Father Fabré, did not alter their opinion, it was owing to a firm persuasion that they had committed no error.

PETIT, *John Lewis*, an eminent surgeon, born at Paris in 1674. He had so early an inclination to surgery, that Mr Littre, a celebrated anatomist, being in his father's house, he regularly attended that gentleman's lectures, from his being seven years of age. He was received master in surgery in the year 1700; and acquired such reputation in the practice of that art, that in 1726 the king of Poland sent for him to his court, and in 1734 the king of Spain prevailed on him to go into that kingdom. He restored the health of those princes; and they endeavoured to detain him by offering him great advantages, but he chose rather to return to France. He was received into the academy of sciences in 1715; became director of the royal academy of surgery; made several important discoveries; and invented new instruments for the improvement of surgery. He died at Paris in 1750. He wrote an excellent Treatise on the Diseases of the Bones, the best edition of which is that of 1723; and many learned Dissertations in the Memoirs of the Academy of Sciences, and in the first volume of the Memoirs of Surgery.

PETITIO PRINCIPII, in *Logic*, the taking a thing for true, and drawing conclusions from it as such, when it is really false; or at least wants to be proved before any inferences can be drawn from it.

PETITION, a supplication made by an inferior to a superior, and especially to one having jurisdiction. It is used for that remedy which the subject hath to help a wrong done by the king, who hath a prerogative not to be sued by writ: In which sense it is either general, That the king do him right; whereupon follows a general indorsement upon the same, *Let right be done the party:* Or it is special, when the conclusion and indorsement are special, for this or that to be done, &c.

By statute, the soliciting, labouring, or procuring the putting the hands or consent of above twenty persons to any petition to the king, or either house of parliament, for alterations in church or state, unless by assent of three or more justices of the peace of the county, or a majority of the grand jury at the assizes or sessions, &c. and repairing to the king or parliament to deliver such petition with above the number of ten persons, is subject to a fine of 100l. and three months imprisonment, being proved by two witnesses within six months, in the court of *B. R.* or at the assizes, &c. And if what is required by this statute be observed, care must be taken that petitions to the king contain nothing which may be interpreted to reflect on the administration; for if they do, it may come under the denomination of a libel: and it is remarkable, that the petition of the city of London for the sitting of a parliament was deemed libellous, because it suggested that the king's dissolving a late parliament was an obstruction of justice; also the petition of the seven bishops, sent to the Tower by James II. was called a libel, &c. To subscribe a petition to the king, *to frighten him into a change of his measures, intimating, that if it be denied many thousands of his subjects will be discontented*, &c. is included among the contempts against the king's person and government, tending to weaken the same, and is punishable by fine and imprisonment.

PETITORY ACTION, in *Scots Law*. See LAW, N° clxxxiii. 18. 20.

PETITOT, JOHN, a curious painter in enamel, who was born at Geneva in 1607, reached a great degree of perfection in the art. He was wonderfully patient in finishing his works, but he had the address to conceal his labour. He only painted the heads and hands of the figures: the hair, grounds, and drapery, being executed by Bordier his brother-in-law. These two artists had the credit of associating and labouring together for fifty years, without the least misunderstanding between them. It is asserted by an ingenious French writer, that Petitot and Bordier derived the knowledge of the most curious and durable colours proper for enamelling, from Sir Theodore Mayerne at London, who recommended Petitot to Charles I. He had the honour to paint the portraits of that monarch and the whole royal family, and continued in England until Charles's unhappy end: he then went to Paris, where he was highly favoured by Louis XIV. and acquired an ample fortune. Being a Protestant, the revocation of the edict of Nantz obliged him to retire to Geneva; but settling soon after at Veray in the canton of Bern, he passed the remainder of his life in ease and affluence. He died in 1691.

Petitot may be called the inventor of painting portraits in enamel. Though his friend Bordier made several attempts before him, and Sir Theodore Mayerne had facilitated the means of employing the most beautiful colours; yet Petitot completed the works, which under his hand acquired a softness and liveliness of colouring that will never change, and will ever render his works variable. He made use of gold and silver plates, and seldom enamelled on copper. When he first came in vogue, his price was 20 louis's a head, which he soon raised to 40. It was his custom to take a painter with him, who painted the picture in oil; after which Petitot sketched out his work, which he always finished after the life. When he painted the king of France, he took those pictures for his copies that most resembled him; and the king afterwards gave him a sitting or two to finish his work.

PETIVER, JAMES, a celebrated English botanist, was contemporary with Plukenet; but we are wholly unacquainted with the precise time of his birth. He was by profession an apothecary, having served an apprenticeship under Mr Feltham, apothecary to Bartholomew's hospital. He settled in Aldersgate-street when he commenced business on his own account, where he continued during the whole of his life. His business was extensive; and he was afterwards chosen apothecary to the Charter-house. Excepting Sir Hans Sloane, and Mr Courten, he was the only person after the Tradescants, who made any important collections in natural history, previous to those of the present day. He employed the captains and surgeons of different ships to bring him home specimens; and by means of printed directions he enabled them to select proper objects. In this manner his collection soon became so valuable, that he was offered 4000l. for it by Sir Hans Sloane, some time prior to his decease; but, after he died, it was purchased by that naturalist. His fame was extended both at home and abroad by his valuable museum. He was chosen a fellow of the Royal Society; and having become acquainted with Ray, he assisted him in arranging the second volume of his History of Plants. He died on the 20th of April, 1718; and his funeral was honoured by the attendance of Sir Hans Sloane, and other eminent men, as pall-bearers.

He published several works, on different subjects of natural history, such as *Musei Petiveriani Centuriæ decem*, 1692—1703, 8vo: *Gazophylacii Naturæ et Artis, Decades decem*, folio, 1702, with 100 plates: A catalogue of Mr Ray's English Herbal, illustrated with figures, folio, 1713, and continued in 1715: Many small publications, which may be found enumerated in Dr Pultney's book: Many papers in the Philosophical Transactions; and a material article in the third volume of Ray's work, entitled, *Plantæ Rariores Chinenses,* *Madras-patanæ, et Africanæ, à Jacobo Petivero ad opus consummandum collatæ*, &c. Many of his small tracts having become scarce, his works were collected and published, exclusive of his papers in the Transactions, in 2 vols. folio, in the year 1764.

PETIVERIA, a genus of plants belonging to the hexandria class, and in the natural method ranking under the 12th order, *Holoraceæ*. See BOTANY *Index*.

PETRA, (Cæsar, Lucian), a town of Greece, on the coast of Illyricum, near Dyrrhachium, and not far from the mouth of the river Panyasus.—Another PETRA, (Livy); a town of Mædica, a district of Thrace, lying towards Macedonia; but in what part of Macedonia, he does not say.

PETRA (Ptolemy), *Petræa* (Silius Italicus), *Petrina* (Italicus), in both which last *urbs* is understood; an inland town of Sicily, to the south-west of Engyum. Now *Petraglia* (Cluverius).

PETRA Jecktael (2 Kings xiv.), a town of the Amalekites; near the Adscensus Scorpionis (Judges i.) and the valley of Salt in the south of Judea; afterwards in the possession of the Edomites, after destroying the Amalekites.

PETRA Recem, or *Rekem*, so called from Rekem king of the Midianites, slain by the Israelites (Num. xxxi.). Formerly called *Arce*, now *Petra*; the capital of Arabia Petræa (Josephus). Ptolemy places it in Long. 66. 45. from the Fortunate islands, and Lat. 30. 20. It declines therefore 80 miles to the south of the parallel of Jerusalem, and 36 miles, more or less, from its meridian to the east. Josephus says, that the mountain on which Aaron died stood near Petra; which Strabo calls the capital of the Nabatæi; at the distance of three or four days journey from Jericho. This Petra seems to be the Sela of Isaiah xvi. 1. and xlii. 11. the Hebrew name of *Petra*, "a rock:" Though some imagine Petra to be no older than the time of the Macedonians.

PETRARCH, FRANCIS, a celebrated Italian poet, was born at Arezzo in 1304, and was the son of Petrarco di Parenzo. He studied grammar, rhetoric, and philosophy, for four years at Carpentras; from whence he went to Montpelier, where he studied the law under John Andreas and Cino of Pistoia, and probably from the latter received a taste for Italian poetry. As Petrarch only studied the law out of complaisance to his father, who on his visiting him at Bologna had thrown in the fire all the Latin poets and orators except Virgil and Cicero; he, at 22 years of age, hearing that his father and mother were dead of the plague at Avignon, returned to that city to settle his domestic affairs, and purchased a country house in a very solitary but agreeable situation, called *Vaucluse;* where he first knew the beautiful Laura, with whom he fell in love, and whom he has immortalized in his poems. He at length travelled into France, the Netherlands, and Germany; and at his return to Avignon entered into the service of Pope John XXII. who employed him in several important affairs. Petrarch was in hopes of being raised to some considerable post: but being disappointed, he applied himself entirely to poetry; in which he met with much applause, that in one and the same day he received letters from Rome and the chancellor of the university of Paris, by which they invited him to receive the poetic crown. By the advice of his friends, he preferred Rome to Paris, and received that crown from the senate and people on the 8th of April 1341. "The ceremony of his coronation (says Gibbon) was performed in the Capitol, by his friend and patron the supreme magistrate of the republic. Twelve patrician youths were arrayed in scarlet; six representatives of the most illustrious families, in green robes, with garlands of flowers, accompanied the procession; in the midst of the princes and nobles, the senator, count of Anguillara, a kinsman of the Colonna, assumed his throne; and at the voice of a herald Petrarch arose. After discoursing on a text of Virgil, and thrice repeating his vows for the prosperity of Rome, he knelt before the throne, and received from the senator a laurel crown, with a more precious declaration, 'This is the reward of merit.' The people shouted, 'Long life to the Capitol and the poet!' A sonnet in praise of Rome was accepted as the effusion of genius and gratitude; and after the whole procession had visited the Vatican, the profane wreath was suspended before the shrine of St Peter. In the act or diploma which was presented to Petrarch, the title and prerogatives of poet-laureat are revived in the Capitol after the lapse of 1300 years; and he receives the perpetual privilege of wearing, at his choice, a crown of laurel, ivy, or myrtle; of assuming the poetic habit; and of teaching, disputing, interpreting, and composing, in all places whatsoever, and on all subjects of literature. The grant was ratified by the authority of the senate and people; and the character of citizen was the recompense of his affection for the Roman name. They did him honour, but they did him justice. In the familiar society of Cicero and Livy, he had imbibed the ideas of an ancient patriot; and his ardent fancy kindled every idea to a sentiment, and every sentiment to a passion." His love of solitude at length induced him to return to Vaucluse; but, after the death of the beautiful Laura, Provence became insupportable to him, and he returned to Italy in 1352; when, being at Milan, Galeas Viceconti made him counsellor of state. Petrarch spent almost all the rest of his life in travelling to and from the different cities in Italy. He was archdeacon of Parma, and canon of Padua; but never received the order of priesthood. All the princes and great men of his time gave him public marks of their esteem; and while he lived at Arcqua, three miles from Padua, the Florentines deputed Boccace to go to him with letters, by which they invited him to Florence, and informed him, that they restored to him all the estate of which his father and mother had been deprived during the dissensions between the Guelphs and Gibelines. He died a few years after at Arcqua, in 1374. He wrote many works that have rendered his memory immortal; these have been printed in four volumes folio. His life has been written by several authors, Amongst these there was one by Mrs Susanna Dobson, in 2 volumes 8vo, collected and abridged from the French. In this work we have the following elegant and just character of Petrarch.

"Few characters, perhaps, have set in a stronger light the advantages of well regulated dispositions than that of Petrarch, from the contrast we behold in one particular of his life, and the extreme misery he suffered from the indulgence of an affection, which, though noble and delightful when justly placed, becomes a reproach and a torment to its possessor when once directed to an improper object. For, let us not deceive ourselves or others; though (from the character of Laura) they are acquitted of all guilt in their personal intercourse, yet, as she was a married woman, it is not possible, on the principles of religion and morality, to clear them from that just censure which is due to every defection of the mind from those laws which are the foundation of order and peace in civil society, and which are stamped with the sacred mark of divine authority.

"In this particular of his character, therefore, it is sincerely hoped that Petrarch will serve as a warning to those unhappy minds, who, partaking of the same feelings under the like circumstances, but not yet suffering his misery, may be led, by the contemplation of it, by a generous regard to the honour of human nature, and by a view to the approbation of that all-seeing Judge who penetrates the most secret recesses of the heart, to check every unhappy inclination in its birth, and destroy, while yet in their power, the seeds of those passions which may otherwise destroy them.

"As to the cavils or censures of those who, incapable of tenderness themselves, can neither enjoy the view of it when presented in its most perfect form, nor pity its sufferings when, as in this work, they appear unhappily indulged beyond the bounds of judgment and tranquillity; to such minds I make no address, well convinced, that, as no callous heart can enjoy, neither will it ever be in danger of being misled, by the example of Petrarch in this tender but unfortunate circumstance of his character.

"To susceptible and feeling minds alone Petrarch will be ever dear. Such, while they regret his failings, and consider them as warnings to themselves, will love his virtues; and, touched by the glowing piety and heart-felt contrition which often impressed his soul, will ardently desire to partake with him in those pathetic and sublime reflections which are produced in grateful and affectionate hearts, on reviewing their own lives, and contemplating the works of God.

"Petrarch had received from nature a very dangerous present. His figure was so distinguished as to attract universal admiration. He appears, in his portraits, with large and manly features, eyes full of fire, a blooming complexion, and a countenance that bespoke all the genius and fancy which shone forth in his works. In the flower of his youth, the beauty of his person was so very striking, that wherever he appeared, he was the object of attention. He possessed an understanding active and penetrating, a brilliant wit, and a fine imagination. His heart was candid and benevolent, susceptible of the most lively affections, and inspired with the noblest sentiments of liberty.

"But his failings must not be concealed. His temper was, on some occasions, violent, and his passions headstrong and unruly. A warmth of constitution hurried him into irregularities, which were followed with repentance and remorse.—No essential reproach, however, could be cast on his manners, till after the 23d year of his age. The fear of God, the thoughts of death, the love of virtue, and those principles of religion which were inculcated by his mother, preserved him from the surrounding temptations of his earlier life."

A resemblance has been traced, in several instances, between this admired poet and our late famous Yorick. —Both, we know, had great wit and genius, and no less imprudence and eccentricity; both were canons, or prebendaries, the Italian of Padua, &c. and the Englishman of York; they both "ran over France, without any business there." If the bishop of Lombes patronised and corresponded with the one, a prelate * of the English church, now deceased, desired, in a letter, to *shandyise* † with the other. In their attachments to Laura and Eliza, both married women, these two prebendaries were equally warm, and equally innocent. And, even after death, a most remarkable circumstance has attended them both; some persons, we are told, stole Petrarch's bones, in order to sell them; and, in like manner, Yorick's body, it is confidently affirmed, was also stolen, and his skull has been exhibited at Oxford.

PETRE, or SALTPETRE. See NITRE, CHEMISTRY and MINERALOGY *Index*.

PETREA, in *Botany*, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, *Personatæ*. See BOTANY *Index*.

PETREL. See PROCELLARIA, ORNITHOLOGY *Index*.

PETRIFACTION, in *Natural History*, denotes the conversion of wood, bones, and other substances, principally animal or vegetable, into stone. These bodies are more or less altered from their original state, according to the different substances they have lain buried among in the earth; some of them having suffered very little change, and others being so highly impregnated with crystalline, sparry, pyritical, or other extraneous matter, as to appear mere masses of stone or lumps of the matter of the common pyrites; but they are generally of the external dimensions, and retain more or less of the internal figure, of the bodies into the pores of which this matter has made its way. The animal substances thus found petrified are chiefly sea-shells; the teeth, bony palates, and bones of fish; the bones of land animals, &c. These are found variously altered, by the insinuation of stony and mineral matter into their pores; and the substance of some of them is now wholly gone, there being only stony, sparry, or other mineral matter remaining in the shape and form.

Respecting the manner in which petrifaction is accomplished, we know but little. It has been thought by many philosophers, that this was one of the rare processes of nature; and accordingly such places as afforded a view of it, have been looked upon as great curiosities. However, it is now discovered, that petrifaction is exceedingly common: and that every kind of water carries in it some earthly particles, which being precipitated from it, become stone of a greater or lesser degree of hardness: and this quality is most remarkable in those waters which are much impregnated with selenitic matter. It has been found by observation, that iron contributes greatly to the process: and this it may do by its precipitation of any aluminous earth which happens to be dissolved in the water by means of an acid; for iron has the property of precipitating this earth. Calcareous earth, however, by being soluble in water without any acid, must contribute very much to the process of petrifaction, as they are capable of a great degree of hardness by means only of being joined with fixed air, on which depends the solidity of our common cement or mortar used in building houses.

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* Dr Gilbert, Arch. York.

† His Grace's own expression.

The name *petrifaction* belongs only, as we have seen, to bodies of vegetable or animal origin; and in order to determine their class and genus, or even species, it is necessary that their texture, their primitive form, and in some measure their organization, be still discernible. Thus we ought not to place the stony kernels, moulded in the cavity of some shell, or other organized body, in the rank of petrifactions, properly so called.

Petrifactions of the vegetable kingdom are almost all either gravelly or siliceous; and are found in gullies, trenches, &c. Those which strike fire with steel are principally found in sandy fissures; those which effervesce in acids are generally of animal origin, and are found in the horizontal beds of calcareous earth, and sometimes in beds of clay or gravel: in which case the nature of the petrifaction is different. As to the substances which are found in gypsum, they seldom undergo any alteration, either with respect to figure or composition, and they are very rare.

Organized bodies, in a state of petrifaction, generally acquire a degree of solidity of which they were not possessed before they were buried in the earth, and some of them are often fully as hard as the stones or matrices in which they are enveloped. When the stones are broken, the fragments of petrifactions are easily found, and easily distinguished. There are some organized bodies, however, so changed by petrifaction, as to render it impossible to discover their origin. That there is a matter more or less agitated, and adapted for penetrating bodies, which crumbles and separates their parts, draws them along with it, and disperses them here and there in the fluid which surrounds them, is a fact of which nobody seems to entertain any doubt. Indeed we see almost every substance, whether solid or liquid, insensibly consume, diminish in bulk, and at last, in the lapse of time, vanish and disappear.

A petrified substance, strictly speaking, is nothing more than the skeleton, or perhaps image, of a body which has once had life, either animal or vegetable, combined with some mineral. Thus petrified wood is not in that state wood alone. One part of the compound or mass of wood having been destroyed by local causes, has been compensated by earthy and sandy substances, diluted and extremely minute, which the waters surrounding them had deposited while they themselves evaporated. These earthy substances, being then moulded in the skeleton, will be more or less indurated, and will appear to have its figure, its structure, its size, in a word, the same general characters, the same specific attributes, and the same individual differences. Farther, in petrified wood, no vestige of ligneous matter appears to exist. We know that common wood is a body in which the volume of solid parts is greatly exceeded by that of the pores. When wood is buried in certain places, lapidific fluids, extremely divided and sometimes coloured, insinuate themselves into its pores and fill them up. These fluids are afterwards moulded, and condensed. The solid part of the wood is decomposed and reduced into powder, which is expelled without the mass by aqueous filtrations. In this manner, the places which were formerly occupied by the wood are now left empty in the form of pores. This operation of nature produces no apparent difference either of the size or of the shape; but it occasions, both at the surface and in the inside, a change of substance, and the ligneous texture is inverted; that is to say, that which was pore in the natural wood, becomes solid in that which is petrified; and that which was solid or full in the first state, becomes porous in the second. In this way, says M. Musard, petrified wood is much less extended in pores than solid parts, and at the same time forms a body much more dense and heavy than the first. As the pores communicate from the circumference to the centre, the petrifaction ought to begin at the centre, and end with the circumference of the organic body subjected to the action of the lapidific fluids. Such is the origin of petrifactions. They are organized bodies which have undergone changes at the bottom of the sea or the surface of the earth, and which have been buried by various accidents at different depths under the ground.

In order to understand properly the detail of the formation of petrified bodies, it is necessary to be well acquainted with all their constituent parts. Let us take wood for an example. Wood is partly solid and partly porous. The solid parts consist of a substance, hard, ligneous, and compact, which forms the support of the vegetable; the porous parts consist of vessels or interstices which run vertically and horizontally across the ligneous fibres, and which serve for conducting air, lymph, and other fluids. Among these vessels, the trachiæ which rise in spiral forms, and which contain only air, are easily distinguished. The cylindric vessels, some of which contain lymph, and others the *succus proprius*, are full only during the life of the vegetable. After its death they become vacant by the evaporation and absence of the fluids with which they were formerly filled. All these vessels, whether ascending or descending, unite with one another, and form great cavities in the wood and in the bark. According to Malpighi and Duhamel, the ligneous fibres are themselves tubular, and afford a passage to certain liquors; in short, the wood and bark are interspersed with utriculi of different shapes and sizes. The augmentation of the trunk in thickness, according to Malpighi is accomplished by the annual addition of a new exterior covering of fibres and of trachiæ. Others think that a concentric layer of sap-wood is every year hardened, whilst a new one is forming from the bark. But it is on all sides agreed that the concentric layers of wood are distinct from one another, because at the point of contact betwixt any two of them, the new vessels, as well as new fibres, are more apparent and perceptible than they are in any other place. Having made these preliminary remarks on the structure of vegetables, we shall now proceed to give an abridged account of the manner in which M. Mongez explains their petrifaction.

In proportion to the tenderness and bad quality of wood, it imbibes the greater quantity of water; therefore this sort will unquestionably petrify more easily than that which is hard. It is thought that all the petrified wood so often found in Hungary has been originally soft, such as firs or poplars. Suppose a piece of wood buried in the earth; if it be very dry, it will suck up the moisture which surrounds it like a sponge. This moisture, by penetrating it, will dilate all the parts of which it is composed. The trachiæ, or air-vessels, will be filled first, and then the lymphatic vessels and those which contain the *succus proprius*, as they are likewise empty. The water which forms this moisture keeps in dissolution a greater or a less quantity of earth; and this earth, detached, and carried along in its course, is reduced to such an attenuated state, that it escapes our eyes and keeps itself suspended, whether by the medium of fixed air or by the motion of the water. Such is the lapidific fluid. Upon evaporation, or the departure of the menstruum, this earth, sand, or metal, again appears in the form of precipitate or sediment in the cavities of the vessels, which by degrees are filled with it. This earth is there moulded with exactness: The lapse of time, the simultaneous and partial attraction of the particles, makes them adhere to one another; the lateral suction of the surrounding fibres, the obstruction of the moulds, and the hardening of the moulded earth, become general; and there consists nothing but an earthy substance which prevents the sinking of the neighbouring parts. If the deposit is formed of a matter in general pretty pure, it preserves a whiter and clearer colour than the rest of the wood; and as the concentric layers are only perceptible and distinct in the wood, because the vessels are there more apparent on account of their size, the little earthy cylinders, in the state of petrified wood, must be there a little larger, and consequently must represent exactly the turnings and separations of these layers. At the place of the utriculi, globules are observed, of which the shapes are as various as the moulds wherein they are formed. The anastomoses of the proper and lymphatic vessels, form besides points of support or reunion for this stony substance.

With regard to holes formed by worms in any bits of wood before they had been buried in the earth, the lapidific fluid, in penetrating these great cavities, deposits there as easily the earthy sediment, which is exactly moulded in them. These vermiform cylinders are somewhat less in bulk than the holes in which they are found, which is owing to the retreat of the more refined earth and to its drying up.

Let any one represent to himself this collection of little cylinders, vertical, horizontal, inclined in different directions, the stony masses of utriculi and of anastomoses, and he will have an idea of the stony substance which forms the ground-work of petrifaction. Hitherto not a single ligneous part is destroyed; they are all existing, but surrounded on every side with earthy deposits: and that body which, during life, was composed of solid and of empty parts, is now entirely solid: its destruction and decomposition do not take place till after the formation of these little deposits. In proportion as the water abandons them, it penetrates the ligneous substance, and destroys it by an insensible fermentation. The woody fibres being decomposed, form in their turn voids and interstices, and there remains in the whole piece nothing but little stony cylinders. But in proportion as these woody fibres disappear, the surrounding moisture, loaded with earth in the state of dissolution, does not fail to penetrate the piece of wood, and to remain in its new cavities. The new deposit assumes exactly the form of decomposed fibres; it envelopes in its turn the little cylinders which were formed in their cavities, and ends by incorporating with them. We may suppose here, that in proportion as it decomposes, there is a reaction of the ligneous part against the lapidific fluid: from this reaction a colour arises which stains more or less the new deposit; and this colour will make it easily distinguishable from that which has been laid in the inside of the vessels. In all petrified wood this shade is generally perceptible.

We have then, says M. Mongez, four distinct epochs in the process by which nature converts a piece of wood into stone, or, to speak more justly, by which she substitutes a stony deposit in its place: 1. Perfect vegetable wood, that is to say, wood composed of solid and of empty parts, ligneous fibres, and of vessels. 2. Wood having its vessels obstructed and choked up by an earthy deposit, while its solid parts remain unaltered. 3. The solid parts attacked and decomposed, forming new cavities betwixt the stony cylinder, which remain in the same state, and which support the whole mass. 4. These new cavities filled with new deposits, which incorporate with the cylinders, and compose nothing else but one general earthy mass representing exactly the piece of wood.

Among the petrifactions of vegetables called *dendrolites*, are found part of shrubs, stems, roots, portions of the trunk, some fruits, &c. We must not, however, confound the impressions of mosses, ferns, and leaves, or incrustations, with petrifactions.

Among the petrifactions of animals, we find shells, crustaceous animals, polyparii, some worms, the bony parts of fishes and of amphibious animals, few or no real insects, rarely birds and quadrupeds, together with the bony portions of the human body. The cornu ammonis are petrified shell-fish; and with regard to figured and accidental bodies, these are *lusus naturæ*.

In order, says M. Bertrand, in his *Dictionnaire des Fossiles*, that a body should become petrified, it is necessary that it be, 1. Capable of preservation under ground: 2. That it be sheltered from the air and running water (the ruins of Herculaneum prove that bodies which have no connection with free air, preserve themselves untouched and entire). 3. That it be secured from corrosive exhalations. 4. That it be in a place where there are vapours or liquids, loaded either with metallic or stony particles in a state of dissolution, and which, without destroying the body, penetrate it, impregnate it, and unite with it in proportion as its parts are dissipated by evaporation.

It is a question of great importance among naturalists, to know the time which Nature employs in petrifying bodies of an ordinary size.—It was the wish of the emperor, duke of Lorraine, that some means should be taken for determining this question. M. le Chevalier de Baillu, director of the cabinet of natural history of his imperial majesty, and some other naturalists, had, several years ago, the idea of making a research which might throw some light upon it. His imperial majesty being informed by the unanimous observations of modern historians and geographers, that certain pillars which are actually seen in the Danube in Servia, near Belgrade, are remains of the bridge which Trajan constructed over that river, presumed that these pillars having been preserved for so many ages behoved to be petrified, and that they would furnish some information with regard to the time which nature employs in changing wood into stone. The emperor thinking this hope well founded, and wishing to satisfy his curiosity, ordered his ambassador at the court of Constantinople to ask permission to take up from the Danube one of the pillars of Trajan's bridge. The petition was granted, and one of the pillars was accordingly taken up; from which it appeared that the petrifaction had only advanced three fourths of an inch in the space of 1500 years. There are, however, certain waters in which this transmutation is more readily accomplished.—Petrifactions appear to be formed more slowly in earths that are porous and in a slight degree moist than in water itself.

When the foundations of the city of Quebec in Canada were dug up, a petrified savage was found among the last beds to which they proceeded. Although there was no idea of the time at which this man had been buried under the ruins, it is however true, that his quiver and arrows were still well preserved. In digging a lead-mine in Derbyshire, in 1744, a human skeleton was found among stags horns. It is impossible to say how many ages this carcase had lain there. In 1695 the entire skeleton of an elephant was dug up near Tonna in Thuringia. Some time before this epoch the petrified skeleton of a crocodile was found in the mines of that country. We might cite another fact equally curious which happened at the beginning of the last century. John Munte, curate of Slægarp in Scania, and several of his parishioners, wishing to procure turf from a drained marshy soil, found, some feet below ground an entire cart with the skeletons of the horses and carter. It is presumed that there had formerly been a lake in that place, and that the carter attempting to pass over on the ice, had by that means probably perished. In fine, wood partly fossil and partly coaly, has been found at a great depth, in the clay of which tile was made for the abbey of Fontenay. It is but very lately that fossil wood was discovered at the depth of 75 feet in a well betwixt Issi and Vauvres near Paris. This wood was in sand betwixt a bed of clay and pyrites, and water was found four feet lower than the pyrites. M. de Laumont, inspector general of the mines, says (*Journal de Physique*, Mai 1736), that in the lead-mine at Pontpéan near Rennes, is a fissure, perhaps the only one of its kind. In that fissure, sea-shells, rounded pebbles, and an entire beech, have been found 240 feet deep. This beech was laid horizontally in the direction of the fissure. Its bark was converted into pyrites, the sap-wood into jet, and the centre into coal.

A great many pieces of petrified wood are found in different counties of France and Savoy. In Cobourg in Saxony, and in the mountains of Misnia, trees of a considerable thickness have been taken from the earth, which were entirely changed into a very fine agate, as also their branches and their roots. In sawing them, the annual circles of their growth have been distinguished. Pieces have been taken up, on which it was distinctly seen that they had been gnawed by worms; others bear visible marks of the hatchet. In fine, pieces have been found which were petrified at one end, while the other still remained in the state of wood fit for being burned. It appears then that petrified wood is a great deal less rare in nature than is commonly imagined.

Cronstedt has excluded petrifactions from any place in the body of his system of mineralogy, but takes notice of them in his appendix. He distinguishes them by the name of *Mineralia Larvata*, and defines them to be "mineral bodies in the form of animals or vegetables." The most remarkable observations concerning them, according to Mr Kirwan, who differs in some particulars from Mongez, are as follow. 1. Those of shells are found on or near the surface of the earth; those of fish deeper; and those of wood deeper still. Shells in substance are found in vast quantities, and at considerable depths. 2. The substances most susceptible of petrifaction are those which most resist the putrefactive process; of which kind are shells, the harder kinds of wood, &c.; while the softer parts of animals, which easily putrefy, are seldom met with in a petrified state. 3. They are most commonly found in strata of marl, chalk, limestone, or clay: seldom in sandstone, still more seldom in gypsum; and never in gneiss, granite, basaltes, or schoerl. Sometimes they are found in pyrites, and ores of iron, copper, and silver; consisting almost always of that kind of earth or other mineral which surrounds them; sometimes of silex, agate, or cornelian. 4. They are found in climates where the animals themselves could not have existed. 5. Those found in slate or clay are compressed and flattened.

The different species of petrifactions, according to Cronstedt, are,

I. *Terræ Larvatæ;* extraneous bodies changed into a limy substance, or calcareous changes. These are, 1. Loose or friable. 2. Indurated. The former are of a chalky nature in form of vegetables or animals; the second filled with solid limestone in the same forms. Some are found entirely changed into a calcareous spar. All of them are found in France, Sweden, and other countries in great plenty.

On these petrifications Cronstedt observes, that shells and corals are composed of limy matter even when still inhabited by their animals, but they are classed among the petrifactions as soon as the calcareous particles have obtained a new arrangement; for example, when they have become sparry; filled with calcareous earth either hardened or loose, or when they lie in the strata of the earth. "These, says he, form the greatest part of the fossil collections which are so industriously made, often without any regard to the principal and only use they can be of, viz. that of enriching zoology. Mineralogists are satisfied with seeing the possibility of the changes the limestone undergoes in regard to its particles; and also with receiving some insight into the alteration with the earth has been subject to from the state of the strata which are now found in it." The calcined shells, where the petrifactions are of a limy or chalky nature, answer extremely well as a manure; but the indurated kind serve only for making grottoes. Gypseous petrifactions are extremely rare; however, Chardin informs us that he had seen a lizard inclosed in a stone of that kind in Persia.

II. Larvæ, or bodies changed into a flinty substance. These are all indurated, and are of the following species. 1. Cornelians in form of shells from the river Tomm in Siberia. 2. Agate in form of wood; a piece of which is said to be in the collection of the Count de Tessin. 3. Coralloids of white flint (*Millepora*) found in Sweden. 4. Wood of yellow flint found in Italy, in Turkey near Adrianople, and produced by the waters of Lough-neagh in Ireland.

III. *Larvæ Argillaceæ;* where the bodies appear to be changed into clay. These are found either loose and friable, or indurated. Of the former kind is a piece of porcelain clay met with in a certain collection, with all the marks of the root of a tree upon it. Of the latter kind is the osteocolla; which is said to be the roots of the poplar-tree changed, and not to consist of any calcareous substance. A sort of fossil ivory, with all the properties of clay, is said likewise to be found in some places.

IV. *Larvæ insalitæ*; where the substances are impregnated with great quantities of salts. Human bodies have been twice found impregnated with vitriol of iron in the mine of Falun, in the province of Dalarne in Sweden. One of them was kept for several years in a glass case, but at last began to moulder and fall to pieces. Turf and roots of trees are likewise found in water strongly impregnated with vitriol. They do not flame, but look like a coal in a strong fire; neither do they decay in the air.

V. Bodies penetrated by mineral inflammable substances. 1. By pit-coal, such as wood; whence some have imagined coal to have been originally produced from wood. Some of these substances are fully saturated with the coally matter; others not. Among the former Cronstedt reckons jet; among the latter the substance called *mumia vegetabilis*, which is of a loose texture, resembling amber, and may be used as such. 2. Those penetrated by asphaltum or rock-oil. The only example of these given by our author is a kind of turf in the province of Skone in Sweden. The Egyptian mummies, he observes, cannot have any place among this species, as they are impregnated artificially with asphaltum, in a manner similar to what happens naturally with the wood and coally matter in the last species. 3. Those impregnated with sulphur which has dissolved iron, or with *pyrites*. Human bodies, bivalve and univalve shells and insects, have been all found in this state; and the last are found in the alum slate at Andrarum, in the province of Skone in Sweden.

VI. *Larvæ metalliferæ;* where the bodies are impregnated with metals. These are, 1, Covered with native silver; which is found on the surface of shells in England. 2. Where the metal is mineralized with copper and sulphur. Of this kind is the falhertz or gray silver ore, in the shape of ears of corn, and supposed to be vegetables, found in argillaceous slate at Frankenberg and Tahlitteren in Hesse. 3. *Larvæ cupriferæ*, where the bodies are impregnated with copper. To this species principally belong the turquoise or Turkey stones, improperly so called; being ivory and bones of the elephant or other animals impregnated with copper. At Simore in Languedoc there are bones of animals dug up, which, during calcination, assume a blue colour; but according to Cronstedt it is not probable that these owe their colour to copper. 4. With mineralized copper. Of these our author gives two examples. One is where the copper is mineralized with sulphur and iron, forming a yellow marcasitical ore. With this some shells are impregnated which lie upon a bed of loadstone in Norway. Other petrifactions of this kind are found in the form of fish in different parts of Germany. The other kind is where the copper is impregnated with sulphur and silver. Of this kind is the gray silver ore, like ears of corn, found in the slate quarries at Hesse. 5. *Larvæ ferriferæ*, with iron in form of a calx, which has assumed the place or shape of extraneous bodies. These are either loose or indurated. Of the loose kind are some roots of trees found at the lake Langelma in Finland. The indurated kinds are exemplified in some wood found at Orbissan in Bohemia. 6. Where the iron is mineralized, as in the pyritaceous larvæ, already described.

VII. Where the bodies are tending to decomposition, or in a way of destruction. Among these, our author enumerates MOULD and TURF. See likewise the article FOSSIL.

We shall add the following description of a very curious animal petrifaction. The Abbé de Sauvages, celebrated for his refined taste and knowledge in natural history, in a tour through Languedoc, between Alais and Uzes, met with a narrow vein of no more than two toises wide, which crosses the road, and is bordered on one side by a gray dirty soil, and on the other by a dry sandy earth, each of a vast extent, and on a level with the narrow vein which separates them. In this narrow vein only are contained petrified shells, cemented together by a whitish marl. They are in prodigious plenty; among which there is one species which the abbé does not remember to have known to have been anywhere described, and may probably be a new acquisition to natural history.

This shell has the shape of a horn, somewhat incurvated towards the base. It seems composed of several cups, let into each other, which are sometimes found separate. They have all deep channels, which extend, as in many other shells, from the base to the aperture; the projecting ribs which form these channels are mostly worn away, being rarely to be found entire. Sometimes several are grouped together; and as a proof that they are not a fortuitous assemblage caused by the petrifaction, they are fixed together through their whole length, in such sort, that their base and aperture are regularly turned the same way. The abbé should have referred this to the genus which Linnæus and the marquis d'Argenville named *dentalis*, had they not been let into each other. He found some of them whose aperture or hollow was not stopped up by the petrifaction, and seemed as cones adapted to one another, forming a row of narrow cells, separated by a very thin partition: this row occupied not more than one half of the cavity of the shell.

Our article has already extended to such a length as to preclude any further additions; we cannot, however, finish it without observing, that fossil bones are very common in Dalmatia. They are of various kinds, and in their nature apparently very extraordinary; but we have found no tolerable account or probable conjecture of their origin. Vitaliano Donati of Padua, in his *Saggio sopra la storie naturale dell' Adriatico*, was the first who took notice of them; and Fortis, in his Travels into Dalmatia, has given a copious account of them. They are most common in the islands of *Cherso* and *Osero*. See Fortis's Travels into Dalmatia; and those of our readers who wish to prosecute this inquiry may consult with advantage Parkinson's Organic Remains of a Former World, two vols. 4to.

PETRIFIED CITY. The story of a petrified city is well known all over Africa, and has been believed by many considerable persons even in Europe. Louis XIV. was so fully persuaded of its reality, that he ordered

Petrified City.

dered his ambassador to procure the body of a man petrified from it at any price. Dr Shaw's account of this affair is as follows: "About 40 years ago (now more than 70), when M. le Maire was the French consul at Tripoli, he made great inquiries, by order of the French court, into the truth of the report concerning a petrified city as Ras Sem; and amongst other very curious accounts relating to this place, he told me a remarkable circumstance, to the great discredit, and even confutation, of all that had been so positively advanced with regard to the petrified bodies of men, children, and other animals.

"Some of the janizaries, who, in collecting tribute, traversed the district of Ras Sem, promised him, that, as an adult person would be too cumbersome, they would undertake, for a certain number of dollars, to bring him from thence the body of a little child. After a great many pretended difficulties, delays, and disappointments, they produced at length a little Cupid, which they had found, as he learned afterwards, among the ruins of Leptis; and, to conceal the deceit, they broke off the quiver, and some other of the distinguishing characteristics of that deity. However, he paid them for it, according to promise, 1000 dollars, which is about 150l. sterling of our money, as a reward for their faithful service and hazardous undertaking; having run the risk, as they pretended, of being strangled if they should have been discovered in thus delivering up to an infidel, one of those unfortunate Mahometans, as they take them originally to have been.

"But notwithstanding this cheat and imposition had made the consul desist from searching after the petrified bodies of men and other animals; yet there was one matter of fact, as he told me, which still very strangely embarrassed him, and even strongly engaged him in favour of the current report and tradition. This was some little loaves of bread, as he called them, which had been brought to him from that place. His reasoning, indeed thereupon, provided the pretended matter of fact had been clear and evident, was just and satisfactory; for where we find loaves of bread, there, as he urged, some persons must have been employed in making them, as well as others for whom they were prepared. One of these loaves he had, among other petrifications, very fortunately brought with him to Cairo, where I saw it, and found it to be an echinites of the discoid kind, of the same fashion with one I had lately found and brought with me from the deserts of Marah. We may therefore reasonably conclude, that there is nothing to be found at Ras Sem, unless it be the trunks of trees, echinites, and such petrifications as have been discovered at other places.

"M. le Maire's inquiries, which we find were supported by the promise and performance of great rewards, have brought nothing further to light. He could never learn that any traces of walls, or buildings, or animals, or utensils, were ever to be seen within the verge of these pretended petrifications. The like account I had from a Sicilian renegado, who was the janisary that attended me whilst I was in Egypt; and as in his earlier years he had been a soldier of Tripoli, he assured me that he had been several times at Ras Sem. This I had confirmed again in my return from the Levant by the interpreter of the British factory at Tunis, who was likewise a Sicilian renegado; and being the libertus or freedman of the bashaw of Tripoli, was preferred by him to be the bey or viceroy of the province of Darna, where Ras Sem was immediately under his jurisdiction. His account was likewise the same; neither had he ever seen, in his frequent journeys over this district, any other petrifications than what are above mentioned. So that the petrified city, with its walls, castles, streets, shops, cattle, inhabitants, and utensils, were all of them at first the mere inventions of the Arabs, and afterwards propagated by such persons, who, like the Tripoli ambassador, and his friend above mentioned, were credulous enough to believe them.

Petrification, Petrobrussians.

"However, there is one remarkable circumstance relating to Ras Sem that deserves well to be recorded. When the winds have blown away the billows of sand, which frequently cover and conceal these petrifications, they discover, in some of the lower and more depressed places of this district, several little pools of water, which is usually of so ponderous a nature, that, upon drinking it, it passes through the body like quicksilver. This perhaps may be that petrifying fluid which has all along contributed to the conversion of the palm trees and the echini into stone: for the formation not only of these, but of petrifications of all kinds, may be entirely owing to their having first of all lodged in a bed of loam, clay, sand, or some other proper nidus or matrix, and afterwards gradually been acted upon and pervaded by such a petrifying fluid as we may suppose this to be."

To this account it may not be amiss to subjoin the memorial of Cassem Aga, the Tripoli ambassador at the court of Britain. The city, he says, is situated two days journey south from Onguela, and 17 days journey from Tripoli by caravan to the south-east. "As one of my friends (says the ambassador) desired me to give him in writing an account of what I knew touching the petrified city, I told him what I had heard from different persons, and particularly from the mouth of one man of credit who had been on the spot: that is to say, that it was a very spacious city, of a round form, having great and small streets therein, furnished with shops, with a vast castle magnificently built: that he had seen there several sorts of trees, the most part olives and palms, all of stone, and of a blue or rather lead colour: that he saw also figures of men in a posture of exercising their different employments; some holding in their hands stuffs, others bread, every one doing something, even women suckling their children, and in the embraces of their husbands, all of stone: that he went into the castle by three different gates, though there were many more, where he saw a man lying upon a bed of stone: that there were guards at the gates with pikes and javelins, in their hands: in short, that he saw in this wonderful city many sorts of animals, as camels, oxen, horses, asses, sheep, and birds, all of stone, and of the colour above mentioned.

We have subjoined this account, because it shows in striking colours the amazing credulity of mankind, and the avidity with which they swallow the marvellous, and the difficulty of discovering the truth respecting places or things at a distance from us.

PETROBRUSSIANS, a religious sect, which had its rise in France and the Netherlands about the year 1110. The name is derived from *Peter Bruys*, a Provençal, who made the most laudable attempt to reform the abuses and remove the superstition that disgraced the beautiful simplicity of the gospel. His followers were numerous; and for 20 years his labour in the ministry was exemplary and unremitted. He was however, burnt in the year 1130 by an enraged populace set on by the clergy.

The chief of Bruys's followers was a monk named *Henry;* from whom the Petrobrussians were also called *Henricians.* Peter the Venerable, abbot of Clugny, has an express treatise against the Petrobrussians; in the preface to which he reduces their opinions to five heads. 1. They denied that children before the age of reason can be justified by baptism, in regard it is our own faith that saves by baptism. 2. They held that no churches should be built, but that those that already are should be pulled down; an inn being as proper for prayers as a temple, and a stable as an altar. 3. That the cross ought to be pulled down and burnt, because we ought to abhor the instruments of our Saviour's passion. 4. That the real body and blood of Christ are not exhibited in the eucharist, but merely represented by their figures and symbols. 5. That sacrifices, alms, prayers, &c. do not avail the dead. F. Langlois objects Manicheism to the Petrobrussians; and says, they maintained two gods, the one good, the other evil: but this we rather esteem an effect of his zeal for the catholic cause, which determined him to blacken the adversaries thereof, than any real sentiment of the Petrobrussians.

PETROJOANNITES, were followers of Peter John, or Peter Joannis, *i. e.* Peter the son of John, who flourished in the 12th century. His doctrine was not known till after his death, when his body was taken out of his grave and burnt. His opinions were, that he alone had the knowledge of the true sense wherein the apostles preached the gospel; that the reasonable soul is not the form of man; that there is no grace infused by baptism; and that Jesus Christ was pierced with a lance on the cross before he expired.

PETROLEUM, or ROCK OIL; a thick oily substance exuding from the earth, and collected on the surface of wells in many parts of the world. See MINERALOGY *Index.*

PETROMYZON, the LAMPREY, a genus of fishes belonging to the order *Cartilaginei.* See ICHTHYOLOGY *Index.*

PETRONIUS was a renowned Roman senator. When governor of Egypt, he permitted Herod, king of the Jews, to purchase in Alexandria any quantity of corn which he should judge necessary for the supply of his subjects, who were afflicted with a severe famine. When Tiberius died, Caius Caligula, who succeeded him, took from Vitellius the government of Syria, and gave it to Petronius, who discharged the duties of his office with dignity and honour. From his inclination to favour the Jews, he run the risk of losing the emperor's friendship and his own life; for when that prince gave orders to have his statue deposited in the temple of Jerusalem, Petronius, finding that the Jews would rather suffer death than see that sacred place profaned, was unwilling to have recourse to violent measures; and therefore preferred a moderation, dictated by humanity, to a cruel obedience. We must not confound him with another of the same name, viz. Petronius Granius, who was a centurion in the eighth legion, and served under Cæsar in the Gallic war. In his voyage to Africa, of which country he had been appointed quæstor, the ship in which he sailed was taken by Scipio, who caused all the soldiers to be put to the sword, and promised to save the quæstor's life, provided that he would renounce Cæsar's party. To this proposal Petronius replied, that Cæsar's officers were accustomed to grant life to others, and not to receive it;" and, at the same time, he stabbed himself with his own sword.

PETRONIUS *Arbiter*, *Titus*, a celebrated critic and polite writer of antiquity, the favourite of Nero, supposed to be the same mentioned by Tacitus in the 16th book of his Annals. He was proconsul of Bithynia, and afterwards consul, and appeared capable of the greatest employments. He was one of Nero's principal confidants, and in a manner the superintendant of his pleasures; for that prince thought nothing agreeable or delightful but what was approved by Petronius. The great favours shown him drew upon him the envy of Tigellinus, another of Nero's favourites, who accused him of being concerned in a conspiracy against the emperor; on which Petronius was seized, and was sentenced to die. He met death with a striking indifference, and seems to have tasted it nearly as he had done his pleasures. He would sometimes open a vein, and sometimes close it, conversing with his friends in the meanwhile, not on the immortality of the soul, which was no part of his creed, but on topics which pleased his fancy, as of love-verses, agreeable and passionate airs; so that it has been said "his dying was barely ceasing to live." Of this disciple of Epicurus, Tacitus gives the following character: "He was (says he) neither a spendthrift nor a debauchee, like the generality of those who ruin themselves; but a refined voluptuary, who devoted the day to sleep, and the night to the duties of his office, and to pleasure." This courtier is much distinguished by a satire which he wrote, and secretly conveyed to Nero; in which he ingeniously describes, under borrowed names, the character of this prince. Voltaire is of opinion that we have no more of this performance but an extract made by some obscure libertine, without either taste or judgment. Peter Petit discovered at Traw in Dalmatia, in 1665, a considerable fragment containing the sequel of Trimalcion's Feast. This fragment, which was printed the year after at Padua and at Paris, produced a paper war among the learned. While some affirmed that it was the work of Petronius, and others denied it to be so, Petit continued to assert his right to the discovery of the manuscript, and sent it to Rome, where it was acknowledged to be a production of the 15th century. The French critics, who had attacked its authenticity, were silent from the moment it was deposited in the royal library. It is now generally attributed to Petronius, and found in every subsequent edition of the works of that refined voluptuary. The public did not form the same favourable opinion of some other fragments, which were extracted from a manuscript found at Belgrade in 1688, and printed at Paris by Nodot in 1694, though they are ascribed by the editor Charpentier, and several other learned men, to Petronius; yet, on account of the Gallicisms, and other barbarous expressions with which they abound, they have generally been considered as unworthy of that author. His genuine works are, 1. A Poem on the civil war between Cæsar and Pompey, translated into prose by Abbé de Marolles, and into French verse by President Bouhier, 1737, in 4to. Petronius, full of fire and enthusiasm, and disgusted with Lucan's flowery language, opposed Pharsalia to Pharsalia; but his work, though evidently superior to the other in some respects, is by no means in the true style of epic poetry. 2. A Poem on the Education of the Roman Youth. 3. Two Treatises; one upon the Corruption of Eloquence, and the other on the Causes of the Decay of Arts and Sciences. 4. A Poem on the Vanity of Dreams. 5. The Shipwreck of Licas. 6. Reflections on the Inconstancy of Human Life. And, 7. Trimalcion's Banquet. To this last performance morality is not much indebted. It is a description of the pleasures of a corrupted court; and the painter is rather an ingenious courtier than a person whose aim is to perform abuses. The best editions of Petronius are those published at Venice, 1499, in 4to; at Amsterdam, 1669, in 8vo, *cum notis variorum;* Ibid. with Boschius's notes, 1677, in 24to; and 1700, two vols. in 24to. The edition of *variorum* was reprinted in 1743, in two vols. 4to, with the learned Peter Burman's commentaries. Petronius died in the year 65 or 66.

Petronius *Maximus*, was born in the year 395, of an illustrious family, being at first a senator and consul of Rome. He put on the imperial purple in 455, after having effected the assassination of Valentinian III. In order to establish himself upon the throne, he married Eudoxia the widow of that unfortunate prince; and as she was ignorant of his villany, he confessed to her, in a transport of love, that the strong desire he had of being her husband, had made him commit this atrocious crime. Whereupon Eudoxia privately applied to Genseric, king of the Vandals, who coming into Italy with a very powerful army, entered Rome, where the usurper then was. The unhappy wretch endeavoured to make his escape; but the soldiers and people, enraged at his cowardice, fell upon him, and overwhelmed him with a shower of stones. His body was dragged through the streets of the city for three days; and, after treating it with every mark of disgrace, they threw it into the Tiber the 12th of June the same year, 455. He reigned only 77 days. He had some good qualities. He loved and cultivated the sciences. He was prudent in his councils, circumspect in his actions, equitable in his judgments; a facetious companion, and steady friend. He had the good fortune to win the affections of every body, while he remained a private character; but as a prince, he was so much the more detestable, in that, after he had obtained the throne by villany, he kept possession of it only by violence. The crown was scarcely on his head before it appeared to him an insupportable burden. "Happy Democles (exclaimed he in his despair), thou wert a king during a single entertainment."

PETROSA OSSA, in *Anatomy*, a name given to the fourth and fifth bones of the cranium, called also *ossa temporum* and *ossa squamosa;* the substance whereof, as their first and last names express, is squamose and very hard. See Anatomy *Index*.

PETROSELINUM (apium petroselinum, Lin.) *Parsley*, a plant which is commonly cultivated for culinary purposes. See Botany and Gardening *Index*.

PETTEIA, in the ancient music, a term to which we have no one corresponding in our language.

The melopœia, or the art of arranging sounds in succession so as to make melody, is divided into three parts, which the Greeks call *lepsis*, *mixis*, and *chresis*; the Latins *sumptio*, *mixio*, and *usus*; and the Italians *presa*, *mescolamento*, and *uso*. The last of these is called by the Greeks *πεττεια*, and by the Italians *pettia*; which therefore means the art of making a just discernment of all the manners of ranging or combining sounds among themselves, so as they may produce their effect, i. e. may express the several passions intended to be raised. Thus it shows what sounds are to be used, and what not; how often they are severally to be repeated; with which to begin, and with which to end; whether with a grave sound to rise, or an acute one to fall, &c. The petteia constitutes the manners of the music; chooses out this or that passion, this or that motion of the soul, to be awakened; and determines whether it be proper to excite it on this or that occasion. The petteia, therefore, is in music much what the manners are in poetry.

It is not easy to discover whence the denomination should have been taken by the Greeks, unless from *πεττεια*, their game of chess, the musical petteia being a sort of combination and arrangement of sounds, as chess is of pieces called *πεττοι*, *calculi*, or "chess-men."

PETTY, Sir William, son of Anthony Petty, a clothier, was born at Rumsey, a small town in Hampshire, in 1623; and while a boy took great delight in spending his time among the artificers, whose trades he could work at when but twelve years of age. Then he went to the grammar school there: at fifteen he was master of the Latin, Greek, and French tongues, and of arithmetic and those parts of practical geometry and astronomy useful to navigation. Soon after he went to Caen in Normandy, and Paris, where he studied anatomy, and read Vesalius with Mr Hobbes. Upon his return to England, he was preferred in the king's navy. In 1643, when the war between the king and parliament grew hot, he went into the Netherlands and France for three years; and having vigorously prosecuted his studies, especially in physic, at Utrecht, Leyden, Amsterdam, and Paris, he returned home to Rumsey. In 1647, he obtained a patent to teach the art of double writing for seventeen years. In 1648, he published at London "Advice to Mr Samuel Hartlib, for the advancement of some particular parts of learning." At this time he adhered to the prevailing party of the kingdom; and went to Oxford, where he taught anatomy and chemistry, and was created a doctor of physic. In 1650, he was made professor of anatomy there; and soon after a member of the college of physicians in London. The same year he became physician to the army in Ireland; where he continued till 1659, and acquired a great fortune. After the restoration, he was introduced to King Charles II. who knighted him in 1661. In 1622, he published "A Treatise of taxes and contributions." Next year he was greatly applauded in Ireland for his invention of a double-bottomed ship. He died at London, in 1687, of a gangrene in the foot, occasioned by the swelling of the gout.

The character of his genius is sufficiently seen in his writings, which were much more numerous than those we have mentioned above. Among these, it is said, he wrote the history of his own life, which unquestionably contained a full account of his political and religious principles, as may be conjectured from what he has left us upon those subjects in his will. In that he has these remarkable words: "As for legacies to the poor, I am at a stand; and for beggars by trade and election, I give them nothing: as for impotents by the hand of God, the public ought to maintain them: as for those who can get no work, the magistrates should cause them to be employed; which may be well done in Ireland, where are fifteen acres of improveable land for every head: as for prisoners for crimes by the king, or for debt by their prosecutors, those who compassionate the sufferings of any object, let them relieve themselves by relieving such sufferers; that is, give them alms (A), &c. I am contented that I have assisted all my poor relations, and put many into a way of getting their own bread, and have laboured in public works and inventions, and have sought out real objects of charity; and do hereby conjure all who partake of my estate, from time to time to do the same at their peril. Nevertheless, to answer custom, and to take the sure side, I give twenty pounds to the most wanting of the parish wherein I die." As for his religion, he says, "I die in the profession of that faith, and in the practice of such worship, as I find established by the laws of my country; not being able to believe what I myself please, nor to worship God better than by doing as I would be done unto, and observing the laws of my country, and expressing my love and honour to Almighty God, by such signs and tokens as are understood to be such by the people with whom I live." He died possessed of a very large fortune, and his family was afterwards ennobled.

The variety of pursuits in which Sir William Petty was engaged, shows him to have had a genius capable of any thing to which he chose to apply it; and it is very extraordinary, that a man of so active and busy a spirit could find time to write so many things as it appears he did.

Petty, any thing little or diminutive, when compared with another.

Petty-Bag, an office in chancery; the three clerks of which record the return of all inquisitions out of every county, and make all patents of comptrollers, gaugers, customers, &c.

Petty-Chaps. See Motacilla, Ornithology *Index*.

Petty-Fogger, a little tricking solicitor or attorney, without either skill or conscience.

Petty, or *Petit*, *Larceny*. See Larceny.

Petty-Patees, among confectioners, a sort of small pies, made of a rich crust filled with sweetmeats.

Petty-Singles, among falconers, are the toes of a hawk.

Petty-Tally, in the sea language, a competent allowance of victuals, according to the number of the ship's company.

Petty, or *Petit*, *Treason*. See Treason.

PETUNSE, in *Natural History*, one of the two substances of which porcelain or china-ware is made. The petunse is a coarse kind of flint or pebble, the surface of which is not so smooth when broken as that of our common flint. See Porcelain.

PETWORTH, in Sussex in England, five miles from Midhurst and the Sussex Downs, and 49 from London, is a large and handsome town, with 2664 inhabitants. It is adorned with several seats of gentlemen, particularly the magnificent seat of the Percies, earls of Northumberland, many of whom lie buried in a separate vault of its church. In the duke of Somerset's armory, in this place, there is a sword which, by circumstances, appears to have been the weapon of the famous Henry Hotspur, though it is less unwieldy than other ancient swords.

PEUCEDANUM, or Sulphur-wort, a genus of plants belonging to the pentandria class, and in the natural method ranking under the 45th order, *Umbellatæ*. See Botany *Index*.

PEUTEMAN, Peter, was born at Rotterdam in 1650, and was a good painter of inanimate objects; but the most memorable particular relative to this artist was the incident which occasioned his death.

He was requested to paint an emblematical picture of mortality, representing human skulls and bones, surrounded with rich gems and musical instruments, to express the vanity of this world's pleasures, amusements, or possessions; and that he might imitate nature with the greater exactness, he went into an anatomy room, where several skeletons hung by wires from the ceiling, and bones, skulls, &c. lay scattered about; and immediately prepared to make his designs.

Dict. of Painters.

While he was thus employed, either by fatigue, or by intense study, insensibly he fell asleep; but was suddenly roused by a shock of an earthquake, which happened at that instant, on the 18th of September 1692. The moment he awoke, he observed the skeletons move about as they were shaken in different directions, and the loose skulls roll from one side of the room to the other; and being totally ignorant of the cause, he was struck with such a horror, that he threw himself down stairs, and tumbled into the street half dead. His friends took all possible pains to efface the impression made on his mind by that unlucky event, and acquainted him with the real cause of the agitation of the skeletons; yet the transaction still affected his spirits in so violent a manner, that it brought on a disorder, which in a short time ended his days. His general subjects were either allegorical or emblematical allusions to the shortness and misery of human life.

PEWIT, Sea-crow, or *Mire-Crow*. See Larus, Ornithology *Index*.

PEWTER, a factitious metal used in making domestic utensils, as plates, dishes, &c.—The basis of the metal is tin, united to small portions of lead, zinc, bismuth, and antimony. "We have (says Dr Watson) three sorts of pewter in common use; they are distinguished by the name of *Plate*, *Trifle*, or *Ley*. The plate pewter is used for plates and dishes; the trifle, chiefly for pints and quarts; and the ley-metal for wine measures, &c. Our very best pewter is said to consist of 100 parts tin, and 17 of antimony, though others allow only 10 parts of the latter[*]." Besides this composition, there are other kinds, compounded of tin, antimony, bismuth, and copper, in several proportions.

[*] Chem. Essays, iv. 167.

PEYRERE, Isaac la, a remarkable character for versatility in religious opinions, was born at Bourdeaux, of Protestant parents, in 1594. He entered the service of

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(A) In the town of Rumsey there is a house which was given by him for the maintenance of a charity-school: the rent of which is still applied to that use.

of the Prince of Conde, who was much pleased with the singularity of his genius. From the perusal of St Paul's writings he took into his head to aver, that Adam was not the first of the human race; and, in order to prove this extravagant opinion, he published in 1655 a book, which was printed in Holland in 4to and in 12mo, with this title: *Præadamitæ, sive exercitatio super versibus* 12, 13, 14. *cap.* 15. *Epistolæ Pauli ad Romanos.* This work was burnt at Paris, and the author imprisoned at Brussels, through the influence of the archbishop of Malines's grand vicar. The Prince of Conde having obtained his liberty, he travelled to Rome in 1656, and there gave in to Pope Alexander VII. a solemn renunciation both of Calvinism and Preadamism. His conversion was not thought to be sincere, at least with regard to this last heresy. His desire to be the head of a new sect is evident; and his book discovers his ambition; for he there pays many compliments to the Jews, and invites them to attend his lectures. Upon his return to Paris, notwithstanding the earnest solicitations of his holiness to remain at Rome, he went again into the Prince of Conde's service in the quality of librarian. Some time after he retired to the seminary *des Vertus*, where he died the 30th of January 1676, at the age of 82, after the sacraments of the church had been administered to him. Father Simon says, that when he was importuned in his last moments to retract the opinion which he had formed respecting the Preadamites, his answer was, *Hi quæcunque ignorant blasphemant.* His having no fixed sentiments of religion is supposed to proceed more from a peculiar turn of mind than a corruption of the heart; for good nature, simplicity of manners, and humanity, seem to have formed his character. "He was (says Niceron) a man of a very equal temper, and most agreeable conversation. He was a little too fond, however, of indulging his wit, which sometimes bordered on raillery; but he took care never to hurt nor wound the feelings of his neighbour. His learning was extremely limited. He knew nothing either of Greek or Hebrew; and yet he ventured to give a new interpretation of several passages of the sacred volume. He piqued himself on his knowledge of the Latin; but excepting a few poets which he had read, he was by no means an adept in that language. His style is very unequal; sometimes swelling and pompous, at other times low and grovelling." Besides the work already mentioned, he has left behind him, I. A treatise as singular as it is scarce, intitled, *Du rappel de Juifs*, 1643, in 8vo. The recal of the Israelites, in the opinion of this writer, will be not only of a spiritual nature, but they will be reinstated in the temporal blessings which they enjoyed before their rejection. They will again take possession of the holy land, which will resume its former fertility. God will then raise up to them a king more just, and more victorious, than any of their former sovereigns had been. Now, though all this is doubtless to be understood spiritually of Jesus Christ, yet our author is of opinion, that it ought also to be understood of a temporal prince, who shall arise for the purpose of effecting the temporal deliverance of the Jews; and that this prince shall be no other than the king of France, for the following reasons, which, it is believed, will carry conviction to few minds: 1. Because the two titles of *Most Christian*, and of *Eldest Son of the Church*, are ascribed to him by way of excellence. 2. Because it is presumable, if the kings of France possess the virtue of curing the evil or scrofula, which can only afflict the bodies of the Jews; that they will likewise have the power of curing their obstinate incredulity, and the other inveterate diseases of their souls. 3. Because the kings of France have for their arms a *fleur de luce;* and because the beauty of the church is in scripture compared to the beauty of lilies. 4. Because it is probable that France will be the country whither the Jews shall first be invited to come and embrace the Christian faith, and whither they shall retreat from the persecution of the nations that have dominion over them; for France is a land of freedom, it admits of no slavery, and whoever touches it is free. Peyrere, after explaining his strange system, proposes a method of converting the Jews to Christianity; a method, says Niceron, which will not be acceptible to many. He proposes to reduce the whole of religion to a bare faith or belief in Jesus Christ; taking it for granted, without any shadow of proof, that "it is as difficult to comprehend the articles of our faith, as to observe the ceremonies of Moses.—From this scheme (says he) there would result a double advantage to the church; the reunion of the Jews, and of all those Christians who are separated from the body of the church." Peyrere, when he wrote this book, was a Calvinist; but his Calvinism too nearly resembled the Deism of our age. He confessed himself, that his reason for quitting the Protestants was on account of their being the first and principal opposers of his book concerning the Preadamites. II. A curious and entertaining account of Greenland, printed in 8vo, 1647. When he was asked, on occasion of this work, why there were so many witches in the north? he replied, "It is because part of the property of these pretended conjurers, when condemned to suffer death, is declared to belong to their judges." III. An equally interesting account of Iceland, 1663, 8vo. IV. A letter to Philotimus, 1658, in 8vo, in which he explains the reasons of his recantation, &c. We find in Moreri the following epitaph of him, written by a poet of his own times.

> La Peyrere ici gît, ce bon Israelite,
> Huguenot, Catholique, enfin Preadamite:
> Quatre religions lui plurent à la fois,
> Et son indifference etoit si peu commune,
> Qu'après quatre-vingts ans qu'il eut à faire un
> choix,
> Le bon homme partit, & n'en choisit pas une.

PEYRONIUS, Francis de la, for a long time practised surgery at Paris with such distinguished eclat, that he obtained for himself the appointment of first surgeon to Louis XV. He improved this favourable situation with his majesty, and procured to his profession those honours which had the effect to quicken its progress, and those establishments which contributed to extend its benefits. The Royal College of Surgery at Paris was founded by his means in 1731, was enlightened by his knowledge, and encouraged by his munificence. At his death, which happened at Versailles the 24th of April 1747, he bequeathed to the society of surgeons in Paris two thirds of his effects, his estate of Marigni, which was sold to the king for 200,000 livres, and his library. This useful citizen also left to the society of surgeons at Montpelier two houses, situated in that town, with 100,000 livres, for the purpose of erecting there a chirurgical amphitheatre. He appointed the same society universal legatee for the third of his effects; and all these legacies contain clauses whose sole object is to promote the public good, the perfection and improvement of surgery; for which he always solicited the protection of the court. At the time of the famous dispute between the physicians and surgeons, he entreated the Chancellor d'Aguessan to build up a brazen wall between the two bodies. "I will do so, replied the minister, but on what side of the wall shall we place the sick:" Peyronius afterwards behaved with more moderation.—He was a philosopher without any ostentation; but his philosophy was tempered by a long acquaintance with the world and with the court. The acuteness and delicacy of his understanding, joined to his natural vivacity, rendered his conversation agreeable; and all these advantages were crowned with a quality still more valuable, an uncommon degree of sympathy for those in distress. He was no sooner known to be at his estate in the country, than his house was filled with sick people, who came to him from the distance of 7 or 8 leagues round about. He had once a plan of establishing, on this spot, an hospital, to which he intended to retire, that he might devote the remainder of his life to the service of the poor.

PEYROUSE, or **Perouse, John Francis Galoup de la**, the celebrated but unfortunate French navigator, was born at Albi in the year 1741. His father intended to train him up to a maritime life, for which purpose he sent him, when very young, to the marine school, where he became enthusiastically attached to his profession, and ambitious to emulate the fame of the most celebrated navigators.

He was appointed midshipman on the 19th of November 1756, behaving with great bravery in that station; and was severely wounded in the engagement between Hawke and Conflans, on the 20th of November 1759. The Formidable, in which he served, was taken, after a vigorous resistance; and it is probable that Peyrouse reaped some advantage from his acquaintance with British officers.

He was promoted, on the 1st of October 1764, to the rank of lieutenant; and as he abhorred a life of ease and idleness, he contrived to be employed in six different ships of war during the peace that subsisted between Great Britain and France. In 1716 he was promoted to the rank of master and commander. In 1779 he commanded the Amazone, belonging to the squadron of Vice-admiral Count d'Estaing; and when that officer engaged Admiral Byron, the post of La Peyrouse was to carry the orders of the admiral to the whole of the line. He afterwards took the sloop Ariel, and contributed to the capture of the Experiment.

In the year 1782, La Peyrouse was sent with the Sceptre of 74 guns, and two frigates of 36 guns each, with some troops and field-pieces on board, to destroy the English settlements in Hudson's Bay, which was easily accomplished, as nothing was found on shore to oppose the smallest force. Having destroyed the settlements, he learned that some of the English had fled at his approach into the woods. He generously left them provisions and arms to defend themselves against the savages.

In the year 1785, he was appointed to the command of some ships employed in a voyage round the world, which unfortunately proved his last. Of this voyage, as far as it was accomplished, full accounts have been already published, from which it is manifest that Peyrouse was admirably qualified to discharge such a trust. He was an experienced and skilful seamen; a man of mathematical and physical science, uncorrupted by that false philosophy which disgraced many of his attendants, and capable of the utmost perseverance in every commendable pursuit. To these excellent qualities he added caution and courage, with a disposition truly benevolent towards the savages whom he visited. Most of the calamities attendant on the voyage, with the exception of the last, were occasioned by the disobedience of his officers, or their neglecting to follow his advice.

The last dispatches of this great and truly excellent man were dated from Botany Bay, February 7. 1788; and since that period, no account of him has been received which is entitled to the smallest credit.

PEZAY, N. Masson, Marquis of, born at Paris, very early applied himself to the study of letters, and afterwards went into the army. He was made a captain of dragoons; and had the honour of giving some lessons on tactics to the ill-fated Louis XVI. Being appointed inspector general of some coasting vessels, he repaired to the maritime towns, and executed his commission with more care and attention than was to have been expected from a votary of the muses. But as, at the same time, he showed too much haughtiness, a complaint was brought against him to the court, and he was banished to his country seat, where he died soon after, in the beginning of 1778. He was the intimate friend and companion of Dorat. He had studied, and successfully imitated, his manner of writing; but his poems have more delicacy, and are less disfigured with trifling conversations of gallantry. He has left behind him, 1. A translation of Catullus, which is not much esteemed. 2. Les Soirées Helvetiennes, Alsaciennes, et Franc-Comtoises, in 8vo, 1770; a work very agreeably diversified, full of charming landscapes, but written with too little accuracy. 3. Les Soirées Provençales, in manuscript, which are said to be nowise inferior in merit to the foregoing ones. 4. La Rosiere de Salency; a pastoral in three acts, and which has been performed with success on the Italian theatres. 5. Les campagnes de Maillebois, in 3 vols 4to, and a volume of maps.

PEZENAS, a place in France about 24 miles from Montpelier. The soil about it is sandy. The rock is limestone. The fields are open, and produce corn, wine, and oil. There are to be seen at this place the extensive ruins of a castle, which formerly belonged to the Montmorency family. This strong fortress was hewn out of the rock on which it stands, and appears to have been complicated and full of art. The walls are lofty, and above 8 feet in thickness. The rock, which is perpendicular, is a mass of shells, such as turbinites, oysters, cockles, with a calcareous cement. From hence the circumjacent plain, decked with luxuriant verdure, and shut in by rugged mountains, affords a most delightful prospect. E. Long. 3. 35. N. Lat. 43. 18.

PEZIZA, **Cup-mushroom**, a genus of plants of the natural order of fungi, belonging to the cryptogamia class. See Botany *Index*.

PHACA, a genus of plants belonging to the diadelphia class; and in the natural method ranking under the 22d order, *Papilionaceæ*. See BOTANY *Index*.

PHÆA, in *Antiquity*, a famous sow which infested the neighbourhood of Cromyon. Theseus destroyed it as he was travelling from Trœzene to Athens to make himself known to his father. Some imagine that the boar of Calydon sprang from this sow. According to some authors, Phæa was a woman who prostituted herself to strangers, whom she murdered, and afterwards plundered.

PHÆACIA, one of the ancient names of the island Corcyra. *Phæaces* the people, who were noted for their indolence and luxury.

PHÆDON, a disciple of Socrates, who had been seized by pirates in his youth; and the philosopher, who seemed to discover something uncommon in his countenance, bought his liberty for a sum of money. Phædon, after Socrates's death, returned to Elis his native country, where he founded a sect of philosophers who composed what was called the *Eliac school*. The name of Phædon is affixed to one of Plato's dialogues.

PHÆDRA, in fabulous history, was a daughter of Minos and Pasiphae; she married Theseus, by whom she was the mother of Acamas and Demophoon. They had already lived for some time in conjugal felicity, when Venus, who hated all the descendants of Apollo, because he had discovered her amours with Mars, inspired Phædra with the strongest passion for Hippolytus the son of Theseus, by the amazon Hippolyte. This passion she long attempted to stifle, but in vain; and therefore, in the absence of Theseus, she addressed Hippolytus with all the impatience of desponding love. He rejected her with horror and disdain. She, however, incensed by the reception she had met, resolved to punish his coldness and refusal; and at the return of Theseus she accused Hippolytus of attempts upon her virtue. He listened to her accusation; and without hearing Hippolytus's defence, he banished him from his kingdom, and implored Neptune, who had promised to grant three of his requests, to punish him in an exemplary manner. As Hippolytus fled from Athens, his horses were suddenly terrified by a sea monster, which Neptune had sent on the shore; and he was thus dragged through precipices and over rocks, trampled under the feet of his horses, and crushed under the wheels of his chariot. When his tragical end was known at Athens, Phædra confessed her crime, and hung herself in despair, unable to survive one whose death her extreme guilt had occasioned. The death of Hippolytus, and the infamous passion of Phædra, is the subject of one of the tragedies of Euripides and of Seneca. She was buried at Trœzene, where her tomb was still to be seen in the time of the geographer Pausanias, near the temple of Venus, which she had built to render the goddess favourable to her incestuous passion. Near her tomb was a myrtle, whose leaves were full of small holes, which, it was reported, Phædra had done with a hair pin, when the vehemence of her passion had rendered her melancholy and almost desperate. She was represented in a painting in Apollo's temple at Delphi, as suspended in the air, while her sister Ariadne stood near to her, and fixed her eyes upon her.

PHÆDRUS, an ancient Latin writer, who composed five books of fables, in iambic verse. He was a Thracian; and was born, as there is reason to conclude, some years before Julius Cæsar made himself master of the Roman empire. How he came into the service of Augustus is not known: but his being called *Augustus's freedman* in the title of the book, shews that he had been that emperor's slave. The fables of Phædrus are valued for their wit and good sense, expressed in very pure and elegant language; and it is remarkable that they remained buried in libraries altogether unknown to the public, until they were discovered and published by Peter Pithou, or Pithœus, a learned French gentleman, toward the close of the 16th century.

PHÆNOMENON, in philosophy, denotes any remarkable appearance, whether in the heavens or earth, and whether discovered by observation or experiment.

PHAETON, in fabulous history, was the son of the Sun, or Phœbus and Clymene, one of the Oceanides. He was son of Cephalus and Aurora, according to Hesiod and Pausanias; or of Tithonus and Aurora, according to Apollodorus. He is, however, more generally acknowledged to be the son of Phœbus and Clymene. He was naturally of a lively disposition, and a handsome figure. Venus became enamoured of him, and entrusted him with the care of one of her temples. This distinguishing favour of the goddess rendered him vain and aspiring; and when Epaphus, the son of Io, had told him, to check his pride, that he was not the son of Phœbus, Phaeton resolved to know his true origin, and at the instigation of his mother he visited the palace of the sun. He begged Phœbus, that if he really were his father, he would give him incontestable proofs of his paternal tenderness, and convince the world of his legitimacy. Phœbus received him with great tenderness, and swore by Styx to grant whatever he requested as a proof of his acknowledging him for his son. The youth boldly asked the direction of the chariot of the sun for one day. His father, grieved and surprised at this demand, used all his arguments to dissuade him from the rash attempt; but all was in vain: and being by his oath reduced to submit to his obstinacy, entrusted him with the reins, after he had directed him how to use them. The young adventurer was however soon sensible of his madness. He was unable to guide the fiery steeds; and loosing the reins, Jupiter, to prevent his consuming the heavens and the earth, struck him with a thunderbolt, and hurled him from his seat into the river Eridanus or Po. His sisters Phaëthusa, Lambetia, and Phœbe, lamenting his loss upon its banks, were changed by the gods into black poplar trees; and Cycnus king of Liguria, also grieving at his fate, was transformed into a swan.

The poets say, that while Phaeton was driving the chariot of his father, the blood of the Ethiopians was dried up; and their skin became black; a colour which is still preserved among the greatest part of the inhabitants of the torrid zone. The territories of Libya were also, they tell us, parched up, on account of their too great vicinity to the sun; and ever since, Africa, unable to recover her original verdure and fruitfulness, has exhibited a sandy country and uncultivated waste. According to those who explain this poetical fable, Phaeton was a Ligurian prince, who studied astronomy, and in whose age the neighbourhood of the Po was visited with uncommon heats.

PHAETON, a genus of birds belonging to the order of anseres. See ORNITHOLOGY *Index*.

PHAGEDÆNA, in *Medicine*, denotes a corroding ulcer.

PHAGEDENIC MEDICINES, those used to eat off proud or fungous flesh; such as are all the caustics.

PHAGEDENIC *Water*, in *Chemistry*, denotes a water make from quicklime and sublimate; and is very efficacious in the cure of phagedenic ulcers. To prepare this water, put two pounds of fresh quicklime in a large earthen pan, and pour upon it about ten pounds of rain-water; let them stand together for two days, stirring them frequently: at last leave the lime to settle well, then pour off the water by inclination, filtrate it, and put it up in a glass bottle, adding to it an ounce of corrosive sublimate in powder; which from white becomes yellow, and sinks to the bottom of the vessel. The water being settled, is fit for use in the cleansing of wounds and ulcers, and to eat off superfluous flesh, and especially in gangrenes; in which case may be added to it a third or fourth part of spirit of wine.

PHALÆNA, the MOTH, a genus of insects belonging to the order of lepidoptera. See ENTOMOLOGY *Index*.

PHALANGIUM, a genus of insects belonging to the order of aptera. See ENTOMOLOGY *Index*.

PHALANGOSIS, in *Surgery*, is a tumour and relaxation of the eyelids, often so great as to deform the eye, and considerably to impede vision. Sometimes the eyelid when in this state subsides or sinks down, occasioned perhaps either by a palsy of the muscle which sustains and elevates the eyelid, or else from a relaxation of the cutis above, from various causes. But in the paralytic or relaxed case, the use of cordial and nervous medicines must be proposed internally; and outwardly, balsam of Peru and Hungary water are to be employed. If all these fail, the remaining method of cure is to extirpate a sufficient quantity of the relaxed cutis.

PHALANX, in Grecian antiquity, a square battalion of soldiers, with their shields joined and pikes crossing each other; so that it was next to impossible to break it.

The Macedonian phalanx is supposed by some to have had the advantage in valour and strength, over the Roman legion. Its number was 8000 men. But the word *phalanx* is used for a party of 28, and several other numbers; and even sometimes for the whole body of foot. See LEGION.

PHALANX is applied, by anatomists, to the three rows of small bones which form the fingers. See ANATOMY *Index*.

PHALARIS, a remarkable tyrant, born at Crete, where his ambitious designs occasioned his banishment: he took refuge in Agrigentum, a free city of Sicily, and there obtained the supreme power by stratagem. The circumstance which has chiefly contributed to preserve his name in history is his cruelty; in one act of which he gave, however, an example of strict justice. It is thus related: Perillus, a brass-founder at Athens, knowing the cruel disposition of Phalaris, contrived a new species of punishment for him to inflict on his subjects. He cast a brazen bull, bigger than the life, with an opening in the side to admit the victim; who being shut up in the body, a fire was kindled under it to roast them to death; and the throat was so contrived, that their dying groans resembled the roaring of a bull. The artist brought it to the tyrant, expecting a great reward. Phalaris admired the invention and workmanship, but ordered the inventor to be put into it to make the first trial. In allusion to which, Ovid says,

———*Neque enim lex æquior ulla,*
Quam necis artifices arte perire sua.

The end of this detestable tyrant is differently related; but it is very generally believed, with Cicero, that he fell by the hands of the Agrigentines; and, as some suppose, at the instigation of Pythagoras. Ovid tells us, that his tongue was cut out; and that he was then put into the bull to perish by the same slow fire by which means he had murdered so many before. Others say that he was stoned to death; and all agree that his end was violent. He reigned, Eusebius says, 28 years; others say 16. After all, there is great uncertainty both as to his life, death, and history. Many of the circumstances related of him, as they are collected by Mr Boyle, depend upon the authenticity of those epistles which go under the name of the tyrant; and which have been justly questioned, and with great probability rejected, as the spurious production of some modern sophist. See BENTLEY, p. 177. col. 2.

PHALARIS, or *Canary-grass*, a genus of plants belonging to the triandria class. See BOTANY *Index*.

PHALERÆ, among the ancient Romans, were military rewards bestowed for some signal act of bravery. Authors do not agree whether the Phaleræ were a suit of rich trappings for a horse, or golden chains something like the torques, but so formed as to hang down to the breast and display a greater profusion of ornament. The last opinion appears to have the greater prevalence, but perhaps both are true.

PHALEREUS (Nepos), a village and port of Athens; this last neither large nor commodious, for which reason Themistocles put the Athenians on building the Piræus; both joined to Athens by long walls. The Phalereus lay nearer the city (Pausanias). Demetrius Phalereus, the celebrated scholar of Theophrastus, was of this place; to whom the Athenians erected above 300 statues; which were afterwards destroyed by his enemies, on his flight to Ptolemy king of Egypt (Strabo). Here Demosthenes was wont to declaim, to accustom his voice to surmount the noise and roaring of the sea; a just and lively emblem of popular assemblies.

PHALEUCIAN VERSE, in ancient poetry, a kind of verse consisting of five feet; the first of which is a spondee, the second a dactyl, and the three last trochees.

PHALLUS, the MOREL, a genus of plants of the order of fungi, and belonging to the cryptogamia class. See BOTANY *Index*.

PHALLUS, among the Egyptians, was the emblem of fecundity. It was very fervently worshipped by women, especially by those who were barren. This custom was introduced among the Greeks; and festivals in honour of it were called *phaluca*. See MYSTERIES, N° 38, &c. Among the Hindoos, a similar emblem called *lingam* is used, and for similar purposes. See HINDOOS, N° 4.

PHALTI, or PHALTIEL, son of Laish. He married Michal, after Saul had taken her from David; but David afterwards took her away from Phalti (1 Sam. xxv. 44. 2 Sam. iii. 15.). Some interpreters are of opinion

nion Phalti did not meddle with Michal all the time she continued in his house, for fear that both of them should incur the penalty of death, to be inflicted on adulterers (Levit. xx. 10.), because Michal had not been legally divorced; but these reasons are frivolous. Saul looked upon David as a rebel to his king, and an outlaw, whose goods and wives belonged to him, and which he could absolutely dispose of. He would not have given Michal to Phalti, nor would he have received her, if he had not thought he might use her as his wife. If Michal had no children by Phalti, by whom then were those children that the scripture says she had, since it is known she had none by David? see 2 Sam. xxi. 8. and vi. 23.

PHANATIC, or FANATIC, a visionary; one who fancies he sees spectres, spirits, apparitions, or other imaginary objects, even when awake; and takes them to be real. See PHANTASY and FANATIC.

Such are phrenetics, necromancers, hypochondriac persons, lycanthropi, &c. See PHRENETIC, HYPOCHONDRIAC, LYCANTHROPI.

Hence the word is also applied to enthusiasts, pretenders to revelation, new lights, prophecies, &c. See ENTHUSIAST, and *SECOND Sight.*

PHANTASIA was the daughter of Nicarchus of Memphis in Egypt. It has been supposed that she wrote a poem on the Trojan war, and another on the return of Ulysses to Ithaca, from which compositions Homer copied the greatest part of his Iliad and Odyssey, when he visited Memphis, where they were deposited.

PHANTASM, a term sometimes used in a synonymous sense with idea, or notion retained in the mind, of an external object.

PHANTASMAGORIA, an optical deception. See SCIENCE, *Amusements of.*

PHANTASY, or FANCY, the *Imagination;* one of the powers of the mind, by which the species of objects received by the external organs of sense are retained, recalled, further examined, and either compounded, or divided: See IMAGINATION; and METAPHYSICS, Part I. Chap. ii. Or it is that internal sense whereby the ideas of absent things are formed, and represented to the mind as if they were present. In melancholics and madmen this faculty is very strong, representing many extravagant and monstrous things, and framing its images as lively as those of sensation: whence the visions and deceptions those persons are liable to.

PHANUEL, of the tribe of Asher, the father of a holy widow and prophetess called Anna, who was in the temple when our Saviour was presented there by his parents (Luke ii. 36, 37, 38.).

PHAON, a young man of Mytilene, in the island of Lesbos, received from Venus, as fable reports, an alabaster vase filled with an essence which had the virtue of conferring beauty. He had no sooner anointed his body with it than he became the most beautiful of men. The ladies of Mytilene fell desperately in love with him; and the celebrated Sappho threw herself down a precipice because he would not encourage her passion. He is said to have been killed by a husband who surprised him with his wife. We have in Ovid a letter from Sappho to Phaon, which Mr Pope has translated into English verse.

PHARA, in *Ancient Geography,* a village between Egypt and Arabia Petræa; or, according to Ptolemy, at a promontory situated between the Sinus Heeroopolites and Elaniticus of the Red sea; where Ismael is said to have dwelt. In Hebrew it is *Paran,* and in most interpreters; *Pharan,* Septuagint and Vulgate. *Pharanitæ,* the people (Ptolemy). *Paran* or *Pharan,* the name of the wilderness in its neighbourhood, adjoining to Cadesh.

PHARÆ, in *Ancient Geography,* a town of Achaia in Peloponnesus, on the river Pierus, 70 stadia from the sea, and to the south of Patræ 150 stadia. Another, of Crete (Pliny); a colony from the *Pharæ* of Messenia (Stephanus). A third *Pharæ,* or *Pheræ* (Strabo, Ptolemy); *Phara, -æ,* (Polybius); a town of Messenia, on the river Nedo (Strabo); on the north side of the Sinus Messenius, and to the north-west of Abea. Anciently read *Pharis* in Homer (Pausanias, Statius), though now read *Phare. Pharitæ* is the name of the people.

PHARAMOND is the name which is given by the generality of historians to the first king of France. He is said to have reigned at Treves, and over a part of France, about the year 420; and to have been succeeded by his son Clodion: but the account which is given of these two princes is very uncertain. It is probable Pharamond was properly no more than a general of an army, the head of a military society of Franks, who were masters of their persons and their fortunes. Gregory of Tours seems to have been of this opinion. "It is not generally known (says he) who was the first king of the French. Sulpitius Severus, who mentions several things respecting that nation, takes no notice of its first monarch; he only says that it had generals." Be that as it may, the institution of the famous Salique law (so named from the Salians the most illustrious of the Franks) is generally attributed to Pharamond. "This law fixed the punishment of crimes, and various points of police. There is no just ground for believing that it expressly settled the right of succession to the crown; it only says, that, with relation to the Salic land, women have no share of heritage, without restricting it to the royal family in particular; for all those were generally called *Salic lands,* which were held by right of conquest; and it is easy to conceive that a nation of soldiers, whose general was their king, would not submit to be governed by a woman. A long custom, supported by the principles of the nation, came in time to be the established law of the kingdom." (See *M. Abbé Millot, Elem. de l'Histoire de France,* tom. i.).

PHARAOH, a common name of the kings of Egypt. Josephus says, that all the kings of Egypt, from Minæus the founder of Memphis, who lived several ages before Abraham, have always had the name of Pharaoh, down to the times of Solomon, for more than 3300 years. He adds, that in the Egyptian language the word *Pharouh* signifies a *king;* and that those princes did not assume this name but when they ascended the throne, at which time they quitted also their former name. From hence it comes to pass, says Josephus, that Herodotus names none of the kings of Egypt after Minæus the builder of Memphis, though he had 330 kings for his successors, because they had all the name of Pharaoh; but because this name did not pass to women also, he names an Egyptian queen Nicaule who ceeded them. Lastly, I find, adds Josephus, from the ancient records of our nation, that from the age of Solomon no king of Egypt had any longer the name of Pharaoh.

But Josephus is not very accurate in this passage. True it is, Herodotus says, that Mines, or Minæus, was the first king of Egypt, and founder of Memphis; that there were 330 kings after him in Egypt; that after them there was a queen called Nicotris, and not Nicaule, as Josephus writes it; but it is not true that these kings had no other name but Pharaoh. Herodotus says expressly, that in the books of the Egyptian priests were read the names and the catalogue of 330 kings; that in this number of 330 there were 18 Ethiopians, and a woman that was a foreigner called Nicotris, and that all the others were Egyptians. These princes therefore had every one his proper name mentioned in the catalogue of the Egyptian kings. So likewise we see in the fragments of Manetho, that every king of Egypt had a name peculiar to him; and we find the name Pharaoh only in Scripture.

What Josephus adds concerning Queen Nicaule, or Nicotris, whom he pretends to be the same as the queen of Sheba, of whom mention is made in Scripture (1 Kings x. 1, 2, &c.) is entirely fabulous; and as to what he says, that since the time of Solomon the kings of Egypt have no longer had the name of Pharaoh, is manifestly false, since we still find his name in the second book of Kings, under Hezekiah (2 Kings xviii. 21.); under Josiah (xxiii. 29, 30, 33, &c.), where this name is joined to Necho, which was the proper name of this prince; under Jehoiakim (xxiii. 35); and in the prophets Isaiah, Jeremiah, and Ezekiel, who are much later than Solomon. It is very probable that the Egyptians gave the name of Pharaoh to their kings as long as the Egyptian language was in common use, and as long as their kings were of their own nation: but after the conquest of Egypt by Alexander the Great, and that the Grecians introduced their language with their government, the name of Pharaoh was known no longer among them. The first prince known to us by the name of Pharaoh was he in whose time Abraham went down to Egypt, when Sarah, who passed only for Abraham's sister, was by the command of Pharaoh brought to his palace in order to become his wife. See ABRAHAM. But the Lord smote Pharaoh and his family with great infirmities, and gave him to know that she was Abraham's wife; whereupon Pharaoh sent for Abraham, restored him his wife, and at the same time gave orders that he should be conducted out of Egypt, with every thing that belonged to him. See SARAH.

The second Pharaoh spoken of in the Scripture is he who reigned when Joseph arrived there. This prince or his successor had the mysterious dream of the fat and lean kine, and the seven full and barren ears of corn, which Joseph explained so much to his satisfaction, that he made him governor of his house and of all Egypt, reserving only to himself the name of a king. This is the same Pharaoh who sent for and entertained the patriarch Jacob and his family in Egypt, and gave them the land of Goshen for their habitation. See JOSEPH and JACOB.

The third Pharaoh known in holy writ is he who persecuted the Israelites. Moses tells us that he was a new king, and had no knowledge of Joseph (Exod. i. 8.). This prince, observing that the Israelites had become very numerous and powerful, resolved to depress them by hardship and labour; and set cruel and pitiless taskmasters over them. But the more he oppressed them, the faster they multiplied; insomuch that he gave orders to the Egyptian midwives, who assisted the Hebrew women in their labour, to put all the male children to death, and to save alive the females only. But this command was not strictly executed. The midwives feared the Lord, and preserved alive not only the female children, but the males also.

Pharaoh, seeing this project did not succeed to his wishes, published a decree (Exod. i. 22.) that all the male children born of Hebrew women should be thrown into the Nile, and that only the females should be spared. This order was rigorously executed; yet by the providence of God Moses was preserved, and even brought up in Pharaoh's own court, by his own daughter, who by chance had found the child, as he was exposed upon the Nile.

Moses being grown up, and having killed an Egyptian who had abused an Hebrew, was obliged to fly from Egypt to avoid that death that Pharaoh had threatened him with.

Several years after, being about 80 years old, he returned again by an order from God, and performed mighty miracles before Pharaoh. See MOSES. There is a good deal of probability that this Pharaoh before whom Moses appeared, and in whose sight he smote Egypt with so many plagues, was a different person from him who would have laid hands on him after he had slain the Egyptian. This same Pharaoh having at last been compelled to send away the Hebrews, and to suffer them to go out of Egypt, soon repented of the leave he had given, and pursued them at the head of his army with his chariots. But he was drowned in the Red sea, wherein he had rashly entered in the eagerness of his pursuit. Some historians pretend to give us the name of this Pharaoh; some, as Apion, call him Amosis or Amasis; Eusebius calls him Chenchris; Usher calls him Amenophis; but we may assure ourselves that there can be nothing certain in all this.

The fifth Pharaoh known to us is he who gave protection to Hadad son of the king of Edom, who gave him to wife the sister of his own queen, enriched him with lands, and brought up his son Genubah in his own court. Hadad returned to Idumea after the death of David.

The sixth Pharaoh is he who gave his daughter in marriage to Solomon king of the Hebrews (1 Kings iii. 1.); and having taken Gezer, he set it on fire, drove the Canaanites out of it, and gave it for a present to Solomon, in lieu of a dowry for his daughter, whom he had married to this prince (1 Kings ix. 16.).

The seventh is Shishak, who entertained Jeroboam in his dominions, a rebellious subject of Solomon, and offered him a refuge in opposition to the king his master. The same Shishak declared war against Rehoboam the son and successor of Solomon, besieged and took Jerusalem, carried away all the king's treasures, and those of the house of God, and particularly the golden bucklers that Solomon had made. See SHISHAK.

The eighth is that Pharaoh with whom Hezekiah made a league against Sennacherib king of Assyria, in the year of the world 3290. See SENNACHERIB. This Pharaoh is probably the same whom Herodotus names

Sethon, priest of Vulcan, who came to meet Sennacherib before Pelusium, and to whose assistance Vulcan sent an army of rats, which gnawed the bowstrings and the thongs of the bucklers of Sennacherib's soldiers.

The ninth is Pharaoh Necho, or Nechos, son of Psammiticus, who made war with Josiah, and subdued him. Herodotus also mentions this prince. See NECHO and EGYPT, N° 11.

The tenth is Pharaoh Hophrah, who entered into an alliance with Zedekiah king of Judah, and attempted to come to his assistance against Nebuchadnezzar king of Chaldea. It was against this Pharaoh that Ezekiel pronounced several of his prophecies (see Ezekiel xxix. xxx. xxxi. xxxii.). He is called Apries in Herodotus, lib. ii. c. 161. He is also mentioned in Habakkuk ii. 15, 16. See also Isaiah xix. xx. and Jeremiah xlvi. 16, &c. See APRIES, and EGYPT, N° 13, &c.

PHARAON is the name of a game of chance, the principal rules of which are: the banker holds a pack consisting of 52 cards; he draws all the cards one after the other, and lays them down alternately at his right and left hand; then the ponte may at his pleasure set one or more stakes upon one or more cards, either before the banker has begun to draw the cards, or after he has drawn any number of couples. The banker wins the stake of the ponte when the card of the ponte comes out in an odd place on his right hand, but loses as much to the ponte when it comes out in an even place on his left hand. The banker wins half the ponte's stake when it happens to be twice in one couple. When the card of the ponte being but once in the stock happens to be the last, the ponte neither wins nor loses; and the card of the ponte being but twice in the stock, and the last couple containing his card twice, he then loses his whole stake. De Moivre has shown how to find the gain of the banker in any circumstance of cards remaining in the stock, and of the number of times that the ponte's cards is contained in it. Of this problem he enumerates four cases, viz. when the ponte's card is once, twice, three, or four times in the stock. In the first case, the gain of the banker is $\frac{1}{n}$, n being the number of cards in the stock. In the second case, his gain is $\frac{\overline{n-2}\times y}{n\times n-1}+\frac{2}{n\times n-1}$, or $\frac{\frac{1}{2}n+1}{n\times n-1}$, supposing $y=\frac{1}{2}$. In the third case, his gain is $\frac{3y}{2\times n-1}$,o $\frac{3}{n\times n-1}$, supposing $y=\frac{1}{2}$. In the fourth case, the gain of the banker, or the loss of the ponte, is $\frac{2n-5}{n-1\times n-3}y$, or $\frac{2n-5}{2\times n-1\times n-3}$ supposing $y=\frac{1}{2}$. De Moivre has calculated a table, exhibiting this gain or loss for any particular circumstance of the play; and he observes, that at this play the least disadvantage of the ponte, under the same circumstances of cards remaining in the stock, is when the card of the ponte is but twice in it, the next greater when three times, the next when once, and the greatest when four times. He has also demonstrated, that the whole gain per cent. of the banker, upon all the money that is adventured at this game, is 2l. 19s. 10d. See De Moivre's Doctrine of Chances, p. 77, &c. p. 105, &c.

PHAREZ, son of Judah and Tamar (Gen. xxxviii. 27, 28, &c.). Tamar being just ready to lie in, found herself with child of twins. One of them appeared first, and putting his arm out, he immediately drew it back again. The midwife tied a scarlet thread upon his arm, to distinguish him for the first-born; but having withdrawn his hand, his brother got before him into the world: whereupon he was called by his mother *Pharez*, i. e. *one breaking forth*; as the other, with the thread on his hand, was called *Zarah*. The sons of Pharez were Hezron and Hamul (Numb. xxvi. 20, 21.). F. Calmet, upon this article, explains the text as if Pharez, and not Zarah, had put out his hand, and drew it in again.

PHARISEES, a famous sect of the Jews, who distinguished themselves by their zeal for the traditions of the elders, which they derived from the same fountain with the written word itself; pretending that both were delivered to Moses from Mount Sinai, and were therefore both of equal authority. From their rigorous observance of these traditions, they looked upon themselves as more holy than other men; and therefore separated themselves from those whom they thought sinners or profane, so as not to eat or drink with them; and hence, from the Hebrew word *pharic*, which signifies "to separate," they had the name of *Pharisees* or *Separatists*.

This sect was one of the most ancient and considerable among the Jews; but its original is not very well known (A); however, it was in great repute in the time of our Saviour; and must have had its original at the same time with the traditions, and they grew up together,

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(A) The Jesuit Serrarius places their first rise about the time of Esdras; because it was then that the Jews first began to have interpreters of their tradition. Maldonat, on the other hand, will not have this sect to have arisen among the Jews till a little before the time of Christ. Others, perhaps, with more probability, refer the origin of the Pharisees to the time of the Maccabees.

Dr Lightfoot thinks, that Pharisaism rose up gradually, from a period which he does not assign, to the maturity of a sect. It is certain, from the account given by Josephus, that in the time of John Hyrcanus, the high priest and prince of the Asmonean line, about 108 years before Christ, the sect was not only formed, but made a considerable figure; and that it had advanced to a high degree of popularity and power about 80 years before Christ. Jos. Ant. lib. xiii. cap. 10. § 5, 6. cap. 15. § 5. and cap 16. § 1. According to Basnage, Hist. of the Jews, book ii. cap. 9. § 2. one Aristobulus, an Alexandrian Jew, and a Peripatetic philosopher, who flourished about 125 years before Christ, and wrote some allegorical commentaries on the scripture, was the author of those traditions, by an adherence to which the Pharisees were principally distinguished from other sects.

gether, till at length they had gained ground so far, that the traditional law swallowed up the written, and those who were the propagators of it the whole bulk of the Jewish nation.

The extraordinary pretences of the Pharisees to righteousness drew after them the common people, who held them in the highest esteem and veneration. Our Saviour frequently, however, charges them with hypocrisy, and making the law of God of no effect through their traditions (Matth. ix. 2. xv. 1—6. xxiii. 13—33. and Luke xi. 39—52.). Several of these traditions are particularly mentioned in the gospel; but they had a vast number more, which may be seen in the Talmud, the whole subject whereof is to dictate and explain those traditions which this sect imposed to be believed and observed.

The Pharisees, contrary to the opinion of the Sadducees, held a resurrection from the dead, and the existence of angels and spirits (Acts xxiii. 8.). But according to Josephus, this resurrection of theirs was no more than a Pythagorean resurrection, that is, of the soul only, by its transmigration into another body, and being born anew with it. From this resurrection they excluded all that were notoriously wicked, being of opinion that the souls of such persons were transmitted into a state of everlasting woe. As to lesser crimes, they held they were punished in the bodies which the souls of those who committed them were next sent into.

Josephus, however, either mistook the faith of his countrymen, or, which is more probable, wilfully misrepresented it, to render their opinions more respected by the Roman philosophers, whom he appears to have on every occasion been desirous to please. The Pharisees had many pagan notions respecting the soul; but Bishop Bull, in his *Harmonia Apostolica*, has clearly proved, that they held a resurrection of the body, and that they supposed a certain bone to remain uncorrupted, to furnish the matter of which the resurrection body was to be formed. They did not, however, believe that all mankind were to be raised from the dead. A resurrection was the privilege of the children of Abraham alone, who were all to rise on Mount Zion; their incorruptible bones, wherever they might be buried, being carried to that mountain below the surface of the earth. The state of future felicity, in which the Pharisees believed, was very gross: They imagined, that men in the next world, as well as in the present, were to eat and drink, and enjoy the pleasures of love, each being reunited to his former wife. Hence the Sadducee, who believed in no resurrection, and supposed our Saviour to teach it as a Pharisee, very shrewdly urged the difficulty of disposing of the woman who had in this world been the wife of seven husbands. Had the resurrection of Christianity been the Pharisaical resurrection, this difficulty would have been insurmountable; and accordingly we find the people, and even some of the Pharisees themselves, struck with the manner in which our Saviour removed it.

This sect seems to have had some confused notions, probably derived from the Chaldeans and Persians, respecting the pre-existence of souls; and hence it was that Christ's disciples asked him concerning the blind man (John ix. 2.), 'Who did sin, this man or his parents, that he was born blind?' And when the disciples told Christ, that some said he was Elias, Jeremias, or one of the prophets (Matt. xvi. 14.), the meaning can only be, that they thought he was come into the world with the soul of Elias, Jeremias, or some other of the old prophets, transmigrated into him. With the Essenes, they held absolute predestination; and with the Sadducees free-will: but how they reconciled these seemingly incompatible doctrines is nowhere sufficiently explained. The sect of the Pharisees was not extinguished by the ruin of the Jewish commonwealth. The greatest part of the modern Jews are still of this sect; being as much devoted to traditions or the oral law as their ancestors were. See the articles CABBALISTS, CARAITES, ESSENES, SADDUCEES, &c.

PHARMACA, among the ancients, meant medicated or enchanted compositions of herbs, minerals, &c. some of which, when taken inwardly, were supposed to cause blindness, madness, love, &c.: others infected by touch; such was the garment sent by Medea to Creusa, prepared *secundum artem:* and others operated upon persons at a distance. *Pharmaca soteria* were employed as antidotes against these mischievous compositions: Thus the herb *moly* preserved Ulysses from the magical influence of Circe. The laurel, the rhamnus, the fleabane, the jasper-stone, were used for similar purposes. See *Potter's Græc. Ant.*

PHARMACI, were two persons who were employed in the lustration or purification of cities. Some say they were both men; but others maintain, that a man to represent the males, and a woman to represent the females, performed this office. They performed sacrifice, and wore figs about their necks called ολλαδες; those of the men were blackish, and those of the women white. Figs were an emblem of fertility, which they doubtless prayed for on these solemn occasions.

PHARMACEUTICAL, any thing connected with pharmacy, or the operations or processes employed in the preparation of medicines.

PHARMACOCHEMIA, an old term denoting that part of the chemical art which treats of the preparation of medicines; by way of distinction from that chemistry, which is wholly employed about the transmutation of metals by means of the philosopher's stone; this being called *spagirico-chemia.*

PHARMACOLOGY, is a treatise of medicines, or the art of preparing, judging of them, &c.

PHARMACOPOEIA (from φαρμακον, *remedy*, and ποιειν, *to make*), means a dispensatory, or a treatise describing the preparations of the several kinds of medicines, with their uses, manner of application, &c.

We have various pharmacopœias, as those of Bauderon, Quercetan, Zwelfer, Charas, Bates, Salmon, Lemery, Lewis, &c. But the Edinburgh, London, and Dublin pharmacopœias, are chiefly consulted and followed in Britain in the present day.

PHARMACOPOLA, or PHARMACOPEIUS, an apothecary, or a person who prepares and sells medicines; but this word is rarely used but in the way of ridicule. It is composed of φαρμακον, *medicine*, and πολειν, *to sell.* Hor. Sat. ii. lib. i. ver. 1.

PHARMACUM, φαρμακον, a medicine or medicament, either of a salutary or deleterious quality.

PHARMACY, the art of preparing, preserving, and compounding medicines. See MATERIA MEDICA. See also PRESCRIPTIONS, *Extemporaneous.*

PHAROS, (Homer, Strabo, &c.), a small oblong island, adjoining to the continent of Egypt, over-against Alexandria. On this island stood a cognominal light-tower, of four sides, each side a stadium in length; and the tower so high as to be seen 100 miles off. Some affirm, each of its four corners rested on a large sea-crab of glass or of hard transparent stone of Ethiopia or Memphis. Others imagine the crabs were only added externally to the base by way of ornament, or as emblematical of its situation and use. The architect was Sostrates the Cnidian, as appears by an inscription on the tower, under Ptolemy Philadelphus, who laid out 800 talents upon it. On account of the port of Alexandria, the entrance to which was difficult and dangerous, the Pharos was called *the key of the Egyptian sea*, or even of Egypt itself (Lucan): and Pharos, from being a proper name, became an appellative to denote all light-houses.

Pharos, or *Phare*, a light-house; a pile raised near a port, where fire is kept burning in the night, to guide and direct vessels near at hand. The pharos of Alexandria, built in the island of Pharos, at the mouth of the Nile, was anciently very famous, insomuch as to communicate its name to all the rest. This most magnificent tower consisted of several stories and galleries, with a lantern at top, in which a light being continually burning, might be seen for many leagues at sea, and along the coast. It was accounted one of the seven wonders of the world. It was built by the famed architect Sostrates, a native of Cnidos, or, according to some, by Deiphanes, the father of Sostrates; and cost Ptolemy Philadelphus 800 talents. The several stories were adorned with columns, ballustrades, galleries of the finest marble and workmanship; to which some add, that the architect had contrived to fasten some looking-glasses so artificially against the highest galleries, that one could see in them all the ships that sailed on the sea for a great way. Instead of which noble structure, one sees now only a kind of irregular castle, without ditches or outworks of any strength, the whole being accommodated to the inequality of the ground on which it stands, and which it seems is no higher than that which it should command. Out of the midst of this clumsy building rises a tower, which serves for a light-house, but which has nothing of the beauty and grandeur of the the old one. The Colossus of Rhodes also served as a pharos.

PHARPAR, or **Pharphar**, is one of the rivers of Damascus, or rather it is an arm of the Barrady or Chrysorrhoas, which waters the city of Damascus and the country about it (2 Kings v. 12.). "Are not Abana and Pharpar, rivers of Damascus, better than all the waters of Israel?" The river of Damascus has its fountain in the mountains of Libanus. At its approach to the city it is divided into three arms, one of which passes through Damascus. The other two water the gardens round about, and then reuniting, they lose themselves at four or five leagues from the city, towards the north. See *Maundrell's Travels from Aleppo to Jerusalem;* see also the articles Abana and Damascus.

PHARSALIA, **Pharsalium**, *Pharsalus*, or *Pharsalos*, in *Ancient Geography*, a town of the Phthiotes, a district of Thessaly, near Pheræ and Larissa, to which last place Pompey fled from the plains of Pharsalus; watered by the river Enipeus, which falls into the Apidanus, and both together into the Peneus. Between Pharsalus and Enipeus, Pompey drew up his men at the fatal battle of Pharsalia.

In this battle, the advantage with respect to numbers was greatly on the side of Pompey. That general himself was on the left with the two legions which Cæsar had returned to him at the beginning of the war. Scipio, Pompey's father-in-law, was in the centre, with the legions he had brought from Syria, and the reinforcements sent by several kings and states of Asia. The Cilician legion, and some cohorts which had served in Spain, were in the right, under the command of Afranius. As Pompey's right wing was covered by the Enipeus, he strengthened the left with his slingers, archers, and the 7000 Roman horse, on whom chiefly his party founded their hopes of victory. The whole army was drawn up in three lines, with very little spaces between them. In conformity to this disposition, Cæsar's army was drawn up in the following order: The tenth legion, which had on all occasions signalized itself above all the rest, was placed in the right wing, and the ninth in the left; but as the latter had been considerably weakened in the action at Dyrrhachium, the eighth legion was posted so near as to be able to support and reinforce it upon occasion. The rest of Cæsar's forces filled up the space between the two wings. Mark Antony commanded the left wing, Sylla the right, and Cneius Domitius Calvinus the main body. As for Cæsar, he posted himself in the right over-against Pompey, that he might have him always in his sight.

Thus was the whole plain covered, from Pharsalia to the Enipeus, with two armies, dressed and armed after the same manner, and bearing the same ensigns, the Roman eagles. Pompey observing how well the enemy kept their ranks, expecting quietly the signal of battle, and on the contrary how impatient and unsteady his own men were, running up and down in great disorder for want of experience, he began to be afraid lest his ranks should be broken upon the first onset; and therefore commanded the foot in the front to keep their ground, and quietly wait for the enemy. The two armies, though within reach of each other, kept a mournful silence; but at length the trumpets sounded the charge, and Cæsar's army advanced in good order to begin the attack, being encouraged by the example of one Caius Crastinus, a centurion, who at the head of 120 men, threw himself upon the enemy's first line with incredible fury. This he did to acquit himself of a promise he had solemnly made to Cæsar, who, meeting him as he was going out of his tent in the morning, asked him, after some discourse, *What his opinion was touching the event of the battle?* To which he, stretching out his hand, replied aloud, *Thine is the victory, Cæsar; thou shalt gloriously conquer, and I myself this day will be the subject of thy praise either dead or alive.* In pursuance of this promise he broke out of his rank as soon as the trumpet sounded; and, at the head of his company, ran in upon the enemy, and made great slaughter of them. But while he was still pressing forward, forcing his way through the first line, one of Pompey's men ran him in at the mouth with such violence, that the point of his sword came out at the hind part of his neck. Upon his death Pompey's soldiers took courage, and with great bravery stood the enemy's onset. While the foot were thus sharply engaged in the centre, Pompey's horse in the left wing marched up confidently; and having first widened their ranks, with a design to surround Cæsar's right wing, charged his cavalry, and forced them to give ground. Hereupon Cæsar ordered his horse to retreat a little, and give way to the six cohorts which he had posted in the rear as a body of reserve. These, upon a signal given, coming up, charged the enemy's horse with that resolution and good order which is peculiar to men who have spent all their lives in camps. They remembered their instructions, not striking at the legs or thighs of the enemy, but aiming only at their faces. This unexpected and new manner of fighting had the desired effect. For the young patricians, whom Cæsar contemptuously calls the *pretty young dancers*, not being able to bear the thoughts of having their faces deformed with scars, turned their backs, and, covering their faces with their hands, fled in the utmost confusion, leaving the foot at the mercy of the enemy. Cæsar's men did not pursue the fugitives; but charging the foot of that wing, now naked and unguarded, surrounded them, and cut most of them in pieces.

Pompey was so transported with rage, in seeing the flower of his forces thus put to flight or cut in pieces, that he left his army, and retired slowly towards his camp, looking more like a man distracted and beside himself than one who by his exploits had acquired the name of *the Great*. When he had reached the camp, he retired to his tent without speaking a word to any; and continued there, like one distracted and out of his senses, till his whole army was defeated. Cæsar no sooner saw himself master of the field than he marched to attack the enemy's entrenchments, that Pompey might not have time to recollect himself. When Pompey was informed that his rival was advancing to attack his entrenchments, he then first seemed to have recovered his senses, and cried out, *What, into my camp too!* He said no more; but immediately laying aside the marks of his dignity, and putting on such a garment as might best favour his flight, he stole out at the decuman gate, and took the road to Larissa, which city had hitherto shown great attachment to him. In the mean time Cæsar began the attack on the enemy's camp, which was vigorously defended by the cohorts Pompey had left to guard it; but they were at length forced to yield. Cæsar was not a little surprised, when, after having forced the entrenchments, he found the enemy's tents and pavilions richly adorned with carpets and hangings, their couches strewed with flowers, their tables ready spread, and sideboards set out with abundance of plate, bowls, and glasses, and some of them even filled with wine. So great was the confidence of Pompey's party, that they made preparations beforehand for pleasures to be enjoyed after the victory, which they thought certain. In Pompey's tent, Cæsar found the box in which he kept his letters: but, with a moderation and magnanimity worthy of himself, he burnt them all, without reading one; saying, that he had rather be ignorant of crimes, than obliged to punish them.

The next day, when the dead were numbered, it appeared that Cæsar had scarce lost 200 men; among whom were about 30 centurions, whom Cæsar caused to be buried with great solemnity. He did particular honours to the body of Crastinus, who had begun the battle; and ordered his ashes to be deposited in a tomb, which he erected to his memory. On Pompey's side, the number of the dead amounted to 15,000 according to some, and to 25,000 according to others. Cæsar took 24,000 prisoners, eight eagles, and 180 ensigns.

Pharsalia, an epic poem, composed by Lucan on the civil war between Pompey and Cæsar, and particularly on the victory of the latter over the former, of which we have given an account in the preceding article. It is a poem universally acknowledged to have great beauties and great defects; but we are the less capable of estimating its merit as a whole, that either time has deprived us of the last books, or its author has left it incomplete. "The subject of the Pharsalia (says an excellent critic) carries undoubtedly all the epic grandeur and dignity: neither does it want unity of object, viz. the triumph of Cæsar over the Roman liberty. In the choice of that subject, he thinks, however, that the author was not happy. The civil wars were too recent to admit in the description of them the embellishments of fiction and machinery. The fables of the gods mixed with the exploits of Cæsar and Pompey, instead of raising, would have diminished, the dignity of such well known facts." Another objection to the subject, perhaps more forcible than this, arises from the success of the war and the abilities of the generals. Lucan was a friend to liberty, and wished to raise the character of Pompey and Cato; but in spite of his utmost efforts, they are always eclipsed by the superior talents and consequent success of Cæsar. All his characters, however, are drawn with spirit, and with uncommon regard to truth; and some of the speeches which he puts into the mouths of his heroes are equal for moral sublimity to any thing that is to be found in all antiquity.

Blair's Lectures.

"There are in the Pharsalia (continues the critic already quoted) several very poetical and spirited descriptions. But the author's chief strength does not lie either in narration or description. His narration is often dry and harsh; his descriptions are often overwrought, and employed too upon disagreeable objects. His principal merit consists in his sentiments, which are generally noble and striking, and expressed in that glowing and ardent manner which peculiarly distinguishes him. Lucan is the most philosophical and the most public-spirited poet of all antiquity. He was the nephew of the famous Seneca the philosopher; was himself a Stoic; and the spirit of that philosophy breathes throughout his poem. We must observe, too, that he is the only ancient epic poet whom the subject of his poem really and deeply interested. Lucan recounted no fiction. He was a Roman, and had felt all the direful effects of the Roman civil wars, and of that severe despotism which succeeded the loss of liberty. His high and bold spirit made him enter deeply into this subject, and kindle, on many occasions, into the most real warmth. Hence, he abounds in exclamations and apostrophes, which are almost always well-timed, and supported with a vivacity and fire that do him no small honour.

"But it is the fate of this poet, that his beauties can never be mentioned, without their suggesting his blemishes also. As his principal excellency is a lively and glowing genius, which appears sometimes in his descriptions, and very often in his sentiments, his great defect in both is want of moderation. He carries every thing to an extreme. He knows not where to stop. From an effort to aggrandize his objects, he becomes tumid and unnatural: and it frequently happens, that where the second line of one of his descriptions is sublime, the third, in which he meant to rise still higher, is perfectly bombast. Lucan lived in an age when the schools of the declaimers had begun to corrupt the eloquence and taste of Rome. He was not free from the infection; and too often, instead of showing the genius of the poet, betrays the spirit of the declaimer; but he is, on the whole, an author of lively and original genius."

PHARUS, a genus of plants belonging to the monœcia class; and in the natural method ranking under the fourth order, *Gramina*. See BOTANY *Index*.

PHARYNX. See ANATOMY, N° 92.

PHASCUM, a genus of plants of the order of musci, belonging to the cryptogamia class. See BOTANY *Index*.

PHASEOLUS, the KIDNEY-BEAN; a genus of plants, belonging to the diadelphia class. See BOTANY *Index*.

PHASES, in *Astronomy*, from the Greek word φαινω, "to appear;" the several appearances or quantities of illumination of the moon, Venus, Mercury, and the other planets. See ASTRONOMY.

PHASGA, or PISGAH, (Moses), a mountain on the other side Jordan, joined to Abarim and Nebo, and running south to the mouth of the Arnon: from which Moses had a view of the promised land, and where he died, having before appointed Joshua his successor. Wells takes Pisgah and Nebo to be different names of one and the same mountain, a part or branch of the mountains Abarim (Deut. xxxii. 49. compared with Deut. xxxiv. 1.). Or that the top of Nebo was peculiarly called *Pisgah;* or some other part of it, cut out in steps, as the primitive word denotes: and thus it is rendered by Aquila, by a Greek word signifying *cut out* (Jerome). There was also a city of this name, *id.*; and the adjoining country was in like manner called *Pisgah*, id.

PHASIANUS, a genus of birds belonging to the order of gallinæ. See ORNITHOLOGY *Index*.

Decline and Fall of the Roman Empire.

PHASIS, a river which falls into the Euxine sea about 700 miles from Constantinople. "From the Iberian Caucasus (says Gibbon), the most lofty and craggy mountains of Asia, that river descends with such oblique vehemence, that in a short space it is traversed by 120 bridges. Nor does the stream become placid and navigable till it reaches the town of Sarapana, five days journey from the Cyrus, which flows from the same hills, but in a contrary direction, to the Caspian lake. The proximity of these rivers has suggested the practice, or at least the idea, of wafting the precious merchandise of India down the Oxus, over the Caspian, up the Cyrus, and with the current of the Phasis into the Euxine and Mediterranean seas. As it successively collects the streams of the plain of Colchos, the Phasis moves with diminished speed, though accumulated weight. At the mouth it is 60 fathoms deep, and half a league broad; but a small woody island is interposed in the midst of the channel: the water, so soon as it has deposited an earthy or metallic sediment, floats on the surface of the waves, and is no longer susceptible of corruption. In a course of 100 miles, 40 of which are navigable for large vessels, the Phasis divides the celebrated region of Colchos or Mingrelia, which, on three sides, is fortified by the Iberian and Armenian mountains, and whose maritime coast extends about 200 miles, from the neighbourhood of Trebizond to Dioscurias and the confines of Circassia. Both the soil and climate are relaxed by excessive moisture: 28 rivers, besides the Phasis and his dependent streams, convey their waters to the sea; and the hollowness of the ground appears to indicate the subterraneous channels between the Euxine and the Caspian."

PHASMATA, in *Physiology*, certain appearances arising from the various shades of colour in the clouds by the light from the heavenly bodies, especially the sun and moon. These are infinitely diversified by the different figures and situations of the clouds, and the appulses of the rays of light; and, together with the occasional flashings and shootings of different meteors, they have, no doubt, occasioned those prodigies of armies fighting in the air, &c. of which we have such frequent accounts in many writers. See 2 Maccab. xi. 8. Melancth. Meteor. 2. Shel. de Comet. ann. 1618.

Kircher and Schottus have erroneously attempted to explain the phenomenon from the reflection of terrestrial objects made on opaque and congealed clouds in the middle region of the air, which, according to them, have the effect of a mirror. Thus, according to those authors, the armies pretended by several historians to have been seen in the skies, were no other than the reflection of the like armies placed on some part of the earth. See *Hist. Acad. Roy. Scienc. ann.* 1726, p. 405, *et seq.*

PHEASANT. See PHASIANUS, ORNITHOLOGY *Index*.

PHEASANT's Eye, or *Bird's Eye*. See ADONIS, BOTANY *Index*.

PHEBE, a deaconess of the port of Corinth, called *Cenchrea*. St Paul had a particular esteem for this holy woman; and Theodoret thinks the apostle lodged at her house for some time, while he continued in or near Corinth. It is thought she brought to Rome the epistle he wrote to the Romans, wherein she is commended and recommended in so advantageous a manner. He says (Rom. xvi. 1, 2.), "I commend unto you Phebe our sister, which is a servant of the church which is at Cenchrea: that ye receive her in the Lord, as becometh saints, and that ye assist her in whatsoever business she hath need of you; for she hath been a succourer of many, and of myself also." Some moderns have advanced a notion, that Phebe was wife to St Paul; but none of the ancients have said any thing like it. It is thought, in quality of deaconess, she was employed by the church in some ministrations suitable to her sex and condition; as to visit and instruct the Christian women, to attend them in their sickness, and distribute alms to them.

PHEGOR, or PEOR, a deity worshipped at a very early period by the Midianites and Moabites, and probably by all the other tribes which then inhabited Syria. Much has been said concerning the functions of this god, and the rank which he held among the Pagan

gan divinities (see (*Baal-Peor*); and many conjectures have been formed concerning the origin of his name. Most of these seem to have no better foundation than the senseless dreams of the Jewish rabbies. PHEGOR, or PEOR, is undoubtedly the same with the Hebrew word *pechor*, which signifies *aperuit*, and probably refers to the prophetic influence always attributed to the solar deity, by which he *opened* or *discovered* things to come. Accordingly we find PHEGOR or PEOR generally joined to *Baal*, which was the Syrian and Chaldean name of the sun after he became an object of worship; hence *Baal-PHEGOR* must have been the sun worshipped by some particular rites, or under some particular character. What these were, a resolution of *Pechor* into its component parts may perhaps inform us. As this word, wherever it occurs in Scripture, has some relation to distending or opening the mouth wide, it is probably compounded of PHAH the *mouth* or *face*, and EHAR *naked*. In those countries we know that the women wore veils; but it would appear, that in celebrating the rites of this deity they were unveiled. It seems even not improbable, that on these occasions the sexes danced promiscuously without their clothes; a practice which would naturally give birth to the licentious amours mentioned in the 25th chapter of the book of Numbers. If this be admitted, it will follow that *Phegor* was the sun presiding over the mysteries of Venus.

PHELLANDRIUM, WATER-HEMLOCK; a genus of plants belonging to the pentandria class. See BOTANY *Index*.

PHENGITES, among the ancients, the name of a beautiful species of alabaster. It is a rude irregular mass, very shattery and friable, but of a brightness superior to that of most other marbles, and excelling them all in transparence. The colour is an agreeable pale, yellowish white, or honey colour; the yellowish is more intense in some places than in others, and sometimes makes an obscure resemblance of veins. It is very weak and brittle in the mass; and when reduced to small pieces, may be easily crumbled between the fingers into loose, but considerably large angular pieces, some perfect, others complex, irregular, or mutilated, and all approaching to a flat shape. The ancients were very fond of this species in public buildings; and the temple of Fortune, built entirely of it, has long been celebrated. Its great beauty is its transparence, from which alone this temple was perfectly light when the doors were shut, though it was built without a window, and had no other light but what was transmitted through the stone of which the walls were built. It was anciently found in Cappadocia, and is still plentiful there: we have it also in Germany and France, and in our own kingdom in Derbyshire, and some other counties. It takes an excellent polish, and is very fit for ornamental works, where no great strength is required.

Hill's Hist. of Fossils, p. 490.

PHENICE, a port of the island of Crete to the west of the island. St Paul having anchored at Phenice, when he was carried to Rome (Acts xxvii. 12.) advised the ship's crew to spend the winter there, because the season was too far advanced.

PHENICIA. See PHOENICIA.

PHEONS, in *Heraldry*, the barbed heads of darts, arrows, or other weapons.

PHEOS, in *Botany*, a name which Theophrastus, Dioscorides, and others, give to a plant used by fullers in dressing their cloths, and of which there were two kinds, a smaller called simply *pheos*, and a larger called *hippopheos*. This plant is sometimes called *phleos*; and is thus confounded with a kind of marsh cudweed, or *gnaphalium*, called also by that name; but it may always be discovered which of the two plants an author means, by observing the sense in which the word is used, and the use to which the plant was put. The *phleos*, properly so called, that is, the cudweed, was used to stuff beds and other such things, and to pack up with earthen vessels to prevent their breaking; but the pheos, improperly called *phleos*, only about cloths: this was, however, also called *stœbe* and *cnaphon*.

PHERECRATES, a Greek comic poet, was contemporary with Plato and Aristophanes. After the example of the ancient comedians, who never introduced upon the theatre imaginary but living characters, he acted his contemporaries. But he did not abuse the liberty which at that time prevailed upon the stage; and laid it down as a rule to himself never to destroy the reputation of any person. Twenty-one comedies are attributed to him, of which there now only remain some fragments collected by Hertelius and Grotius. From these fragments, however, it is easy to discern, that Pherecrates wrote the purest Greek, and possessed that ingenious and delicate raillery which is called *attic urbanity*. He was author of a kind of verse called, from his own name, *Pherecratick*. The three last feet were in hexameter verse, and the first of those three feet was always a spondee. The verse of Horace (for example, *Quamvis pontica pinus*) is a Pherecratick verse. We find in Plutarch a fragment of this poet upon the music of the Greeks, which has been critically examined by M. Burette of the academy of inscriptions. See the 15th volume of the collection published by that learned society.

PHERECYDES, a native of Scyros, flourished about the year 560 before the Christian era, and was disciple of Pittacus, one of the seven wise men of Greece (see PITTACUS). He is said to have been the first of all the philosophers who has written on natural subjects and the essence of the gods. He was also the first, it is said, who held the ridiculous opinion, "that animals are mere machines." He was Pythagoras's master, who loved him as his own father. This grateful scholar having heard that Pherecydes lay dangerously ill in the island of Delos, immediately repaired thither, in order to give every necessary assistance to the old man, and to take care that no means should be left untried for the recovery of his health. His great age, however, and the violence of his disease, having rendered every prescription ineffectual, his next care was to see him decently buried; and when he had paid the last duty to his remains, and erected a monument to his memory, he set out again for Italy. Other causes have been assigned for the death of Pherecydes: some say he was eaten up by lice, and others that he fell headlong from the top of Mount Corycius in his way to Delphos. He lived to the age of 85 years, and was one of the first prose writers among the Greeks.

"Marvellous circumstances have been related of him, which only deserve to be mentioned, in order to show that what has been deemed supernatural by ignorant

Enfield's History of Philosophy.

spectators may be easily conceived to have happened from natural causes. A ship in full sail was at a distance approaching its harbour; Pherecydes predicted that it would never come into the haven, and it happened accordingly; for a storm arose which sunk the vessel. After drinking water from a well, he predicted an earthquake, which happened three days afterwards. It is easy to suppose that these predictions might have been the result of a careful observation of those phenomena which commonly precede storms or earthquakes in a climate where they frequently happen.

"It is difficult to give in any degree an accurate account of the doctrines of Pherecydes; both because he delivered them, after the manner of the times, under the concealment of symbols; and because very few memoirs of this philosopher remain. It is most probable that he taught those opinions concerning the gods and the origin of the world which the ancient Grecian theogonists borrowed from Egypt;" and of which the reader will find accounts in different articles of this work. See EGYPT, METAPHYSICS, MYSTERIES, MYTHOLOGY, and POLYTHEISM.

PHERETIMA, was the wife of Battus king of Cyrene, and the mother of Arcesilaus. After his son's death, she recovered the kingdom by means of Amasis king of Egypt, and to avenge the murder of Arcesilaus, she caused all his assassins to be crucified round the walls of Cyrene, and she cut off the breasts of their wives, and hung them up near the bodies of their husbands. It is said that she was devoured alive by worms; a punishment which, according to some of the ancients, was inflicted by Providence for her unparalleled cruelties.

PHIAL, a well-known vessel made of glass, used for various purposes.

Leyden PHIAL, is a phial of glass coated on both sides with tin-foil for a considerable way up the sides, of great use in electrical experiments. The discovery that electricity may be accumulated in an apparatus of this kind, was originally made in the year 1745 by Mr Von Kleist, dean of the cathedral in Comin. But this remarkable property was first satisfactorily observed at Leyden, with a bottle containing some water which served for the inside coating, and the accidental application of the hands on the outside served for another coating. Hence a bottle coated on both sides for the purpose of being charged with electricity, has received the name of *Leyden phial*, or otherwise *electric jar*. See ELECTRICITY, *passim*.

PHIDIAS, the most famous sculptor of antiquity, was an Athenian, and a contemporary of the celebrated Pericles, who flourished in the 83d Olympiad. This wonderful artist was not only consummate in the use of his tools, but accomplished in those sciences and branches of knowledge which belong to his profession, as history, poetry, fable, geometry, optics, &c. He first taught the Greeks to imitate nature perfectly in this way; and all his works were received with admiration. They were also incredibly numerous; for it was almost peculiar to Phidias, that he united the greatest facility with the greatest perfection. His Nemesis was ranked among his first pieces: it was carved out of a block of marble, which was found in the camp of the Persians after they were defeated in the plains of Marathon. He made an excellent statue of Minerva for the Plateans; but the statue of this goddess in her magnificent temple at Athens, of which there are still some ruined remains, was an astonishing production of human art. Pericles, who had the care of this pompous edifice, gave orders to Phidias, whose prodigious talents he well knew, to make a statue of the goddess; and Phidias formed a figure of ivory and gold 39 feet high. Writers never speak of this illustrious monument of skill without raptures; yet what has rendered the name of the artist immortal, proved at that time his ruin. He had carved upon the shield of the goddess his own portrait and that of Pericles; and this was, by those that envied him, made a crime in Phidias. He was also charged with embezzling part of the materials which were designed for the statue. Upon this he withdrew to Elis, and revenged himself upon the ungrateful Athenians, by making for the Elians the Olympic Jupiter: a prodigy of art, and which was afterwards ranked among the seven wonders of the world. It was of ivory and gold; 60 feet high, and every way proportioned. "The majesty of the work did equal the majesty of the god (says Quintilian), and its beauty seems to have added lustre to the religion of the country." Phidias concluded his labours with this masterpiece: and the Elians, to do honour to his memory, erected, and appropriated to his descendants, an office, which consisted in keeping clean this magnificent image.

PHIDITIA, in Grecian antiquity, feasts celebrated with great frugality at Sparta. They were held in the public places and in the open air. Rich and poor assisted at them equally, and on the same footing; their design being to keep up peace, friendship, good understanding, and equality among the citizens great and small. It is said that those who attended this feast brought each a bushel of flour, eight measures of wine named *chorus*, five pounds of cheese, and two pounds and a half of figs, with some money.

PHILA, in *Mythology*, one of the attributes of Venus, which distinguishes her as the mother of love, from *φιλειν, to love*.

PHILADELPHIA, in antiquity, were games instituted at Sardis to celebrate the union of Caracalla and Geta, the sons of Septimius Severus.

PHILADELPHIA, the capital of the state of Pensylvania in North America, situated in W. Long. 75. 8. N. Lat. 39. 57. It is one of the most beautiful and regular cities in the world, being of an oblong form, situated on the west bank of the river Delaware, on an extensive plain, about 118 miles (some say more) from the sea. The length of the city east and west, that is, from the Delaware to the Schuylkill, upon the original plan of Mr Penn, is about three miles, and the breadth, north and south, rather less than one mile. But a great part of the plot covered by the city charter is yet unbuilt. The inhabitants, however, have not confined themselves within the original limits of the city, but have built north and south along the Delaware two miles in length. The longest street is Second-street, about 700 feet from Delaware river, and parallel to it. The circumference of that part of the city which is built, if we include Kensington on the north and Southwark on the south, may be about five miles. Market-street is 100 feet wide, and runs the whole length of the city from

Philadelphia.

river to river. Near the middle, it is intersected at right angles by Broad-street, 113 feet wide, running nearly north and south quite across the city.

The Delaware river at Philadelphia is 1362 yards wide, with sufficient depth of water to admit a 64 gun-ship. The tide rises six feet, and flows at the rate of four miles an hour. Between Delaware river and Broad-street are 14 streets, nearly equidistant, running parallel with Broad-street across the city; and between Broad-street and the Schuylkill, there are nine streets equidistant from each other. Parallel to Market-street are eight other streets, running east and west from river to river, and intersecting the cross streets at right angles; all these streets are 50 feet wide, except Arch-street, which is 65 feet wide. All the streets which run north and south, except Broad-street mentioned above, are 50 feet wide. There were four squares of eight acres each, one at each corner of the city, originally reserved for public and common uses. And in the centre of the city, where Broad-street and Market-street intersect each other, is a square of ten acres, reserved in like manner, to be planted with rows of trees for public walks. This city was founded in 1682 by the celebrated William Penn, who in October 1701 granted a charter incorporating the town with city privileges. The houses are of brick, but generally handsome. The streets are clean and regular, but the foot-paths are often obstructed by the entrances to the cellars. The population in 1810 was 98,866, and in 1818 it was estimated at 120,000. Rents are 25 per cent. lower than at New York, but they are still high, compared with house-rents in Britain.

Their places for religious worship are as follows: The Friends or Quakers have five, the Presbyterians six, the Episcopalians three, the German Lutherans two, the German Calvinists one, the Catholics three, the Swedish Lutherans one, the Moravians one, the Baptists one, the Universal Baptists one, the Methodists two, the Jews one.

The other public buildings in the city, besides the university, academies, &c. are the following, viz. a state-house and offices, a carpenter's hall, a philosophical society's hall, a dispensary, an hospital and offices, an alms-house, a house of correction, a public factory of linen, cotton, and woollen, a public observatory, three brick market-houses, a fish-market, a public gaol.

The poor-laws are administered by 16 citizens, chosen annually by the corporation. They are empowered, with the approbation of four aldermen and two justices, to levy an assessment not exceeding one per cent. nor more than three dollars per head on every free man not otherwise rated. The annual average number of paupers supported in alms-houses of this city is 1600 (1818); the expence of supporting them 70,000 dollars a-year. The produce of the poor-tax for the city and county of Philadelphia 140,000 dollars.

In Philadelphia there are, besides several squares, about 34 streets, many of which are very broad, and all of them neat and elegant, lighted by lamps of two branches each. The expence of lighting and watching Philadelphia was 25,000 dollars per annum in 1818. Here is a library which owed its origin to Dr Franklin, was incorporated in 1742, and now contains upwards of 30,000 volumes, besides a museum and a valuable philosophical apparatus. There is a theatre in Chesnut-street, which was finished in 1793. The university stands on the west side of Fourth-street, and was incorporated in the year 1791, the funds of which produce annually a revenue of about 2365l. and the students on an average amount to 510. In the city and suburbs are 10 rope-walks, 13 breweries, 6 sugar-houses, 7 hair-powder manufactories, 2 rum-distilleries, 15 manufactories of earthen ware, and the public mint for the whole United States.

The university of Philadelphia was founded during the war. Its funds were partly given by the state, and partly taken from the old college of Philadelphia. A medical school, which was founded in 1765, is attached to the university; and has professors in all the branches of medicine, who prepare the students for degrees in that science. Besides the university and medical school, there is the Protestant Episcopal academy, a very flourishing institution; the academy for young ladies; another for the Friends or Quakers, and one for the Germans, besides five free schools.

In Market-street, between Front and Fourth-streets, is the principal market, built of brick, and is 1500 feet in length. This market, in respect to the quantity, the variety, and neatness of the provisions, is not equalled in America, and perhaps not exceeded in the world.

There are various literary and philosophical institutions in Philadelphia. The American Philosophical Society was incorporated in 1780, and has published five volumes of Transactions. The Philadelphia Medical Society established in 1790; the College of Physicians in 1789; the Medical Lyceum in 1804; the Academy of Fine Arts in 1805; the Linnean Society in 1806; the Agricultural Society in 1809; and the Academy of Natural Sciences, which commenced a a Journal in 1817. Peale's Museum, founded in 1784, contains an extensive collection of objects connected with natural history.

The style of living in Philadelphia is substantial, and among the richer classes splendid, though not very refined. Many of the houses are richly furnished, and a considerable number of carriages are kept. All classes live well, and apparently there is less economy and less exertion than in England. The dress of the gentlemen is taken from England, that of the ladies from France. The distinction between the blacks and whites is jealously kept up here. The former are not allowed to go into the same church with the latter.

The wages of labour and prices of commodities in Philadelphia may serve as a specimen of those of the large towns of America generally. In October 1817, according to Mr Fearon, labourers were paid from 4s. 6d. to 5s. 7d. per day; female servants 4s. 6d. to 9s. per week, with board; men servants 54s. to 67s. 6d. per month; carpenters from 31s. 6d. to 40s. 6d. per week; shoemakers 31s. 6d. to 40s. 6d.;—they work more hours than in London. Fish from 2d. to 6¼d. per pound; beef 5¼d.; bacon 7d. to 8d.; butter 17d. to 20d.; fowls 16d. to 2s. 3d.; turkeys 5s. 6d.; flour 10 dollars per barrel of 196 pounds; lump sugar 1s. to 1s. 5d.; tea 4s. 6d. to 9s.; Liverpool salt 3s. 4d. per bushel; Shoes 13s. 6d. to 15s. 9d. per pair; best hats 40s. 6d.; superfine coats 8l. 1s. 6d.

The philanthropic and useful institutions in Philadelphia are very numerous and extremely well conducted. In the Alms House and House of Employment,

ment, the average number of persons maintained in 1810 was 735; and the average weekly expence for each was 1 dollar 21 cents per week. The poor are employed here in the fabrication of coarse manufactures. The Friends Alms House was established by the Quakers for the infirm and indigent members of their own community. The Abolition Society for promoting the abolition of slavery, and for the relief of free negroes unlawfully held in slavery, was established in 1774. The Washington Benevolent Society has nearly 3000 members. The asylum for the relief of lunatics was planned by the Quakers in 1813. The society for alleviating the misery of public prisons, instituted in 1787, has been the means of introducing great improvements into these establishments. The Pensylvania hospital, founded in 1756, affords relief to poor persons afflicted with diseases. The Dispensary affords medical advice and assistance to the indigent sick who are unable to pay for a physician.

The Penitentiary of this city has been justly celebrated, as having set the first example of the efficacy of labour, and a system of moral discipline, in reforming the lives of criminals, and in diminishing the expence of prisons, by rendering the labour of the prisoners the source of their own support. The prison instead of being a scene of idleness, debauchery, and profanity, has the appearance of a large manufactory, in which all are usefully employed, and none seem extremely unhappy. The leading features of the system of discipline established here, will be understood from the following account of the regulations given in "Mease's Picture of Philadelphia:"

"1. Cleanliness, so intimately connected with morality, is the first thing attended to, previously to any attempts at that internal purification, which it is the object of the discipline to effect. The criminal is washed, his clothes effectually purified and laid aside, and he is clothed in the peculiar habit of the jail, which consists of grey cloth, made by the prisoners, adapted to the season. The attention to this important point is unremitted, during their confinement. Their faces and hands are daily washed; they are shaved, and change their linen once a-week; their hair is kept short; and, during the summer, they bathe in a large tub. Their apartments are swept and washed once or twice a-week, as required, throughout the year.

"2. Work, suitable to the age and capacity of the convicts, is assigned, and an account is opened with them. They are charged with their board, clothes, the fine imposed by the state, and expence of prosecution, and credited for their work; at the expiration of the time of servitude, half the amount of the sum, if any, left after deducting the charges, is required by law to be paid to them. As the board is low, the labour constant, and the working hours greater than among mechanics, it is easy for the convicts to earn more than the amount of their expences; so that, when they go out, they receive a sum of money sufficient to enable them to pursue a trade, if so disposed, or, at least, that will keep them from want until they find employ, and prevent the necessity of stealing. On several occasions, the balance paid to a convict has amounted to more than one hundred dollars; in one instance it was one hundred and fifty dollars; and from ten to forty dollars are commonly paid.—When, from the nature of the work at which the convict has been employed, or his weakness, his labour does not amount to more than the charges against him, and his place of residence is at a distance from Philadelphia, he is furnished with money to bear his expences home. The price of boarding is sixteen cents per day, and the general cost of clothes for a year is nineteen dollars thirty-three cents.

"3. The prisoners lie on the floor, on a blanket, and about thirty sleep in one room; they are strictly prohibited from keeping their clothes on at night. The hours for rising and retiring are announced by a bell; and at those times they go out and come in with the greatest regularity. For their own comfort, they have established a set of rules respecting cleanliness, on breach of which a fine is exacted. No one is permitted even to spit on the floor. A large lamp is hung up, out of the reach of the prisoners, in every room, which enables the keeper or watch to see every man; and for this purpose a small aperture is made in every door. The end of the cord by which the lamps are suspended is outside of the rooms; the solitary cells is the punishment for extinguishing these lamps.

"4. Their diet is wholesome, plain, and invigorating, and their meals are served up with the greatest regularity and order; a bell announces when they are ready, and all collect at the door leading to the passage where they eat, before any one is allowed to enter. They then take their seats without hurry or confusion, and all begin to eat at the same time. While eating, silence is strictly enjoined by the presence of the keepers, who give notice of the time for rising from table. For breakfast, they have about three-fourths of a pound of good bread, with molasses and water. At dinner, half a pound of bread and beef, a bowl of soup and potatoes. Sometimes herrings in the spring. At supper, corn meal mush (mash?) and molasses, and sometimes boiled rice.

"The black seat at a separate table. There is also a table set apart for those who have committed offences for the first time, but not of sufficient enormity to merit the solitary cells; such as indolence, slighting work, impudence, &c.; and to such no meat is given. Every one finds his allowance ready on his trencher. The drink is molasses and water, which has been found to be highly useful, as a refreshing draught, and as a medicine. Spirituous liquors or beer never enter the walls of the prison. The cooks and bakers, who are convicts, are allowed thirty cents per day by the inspectors. The decency of deportment, and the expression of content, exhibited by the convicts at their meals, renders a view of them, while eating, highly interesting. No provisions are permitted to be sent to the convicts from without.

"5. The regularity of their lives almost secures them against disease. A physician, however, is appointed to attend the prison; a room is appropriated for the reception of the sick or hurt, and nurses to attend them. The effect of the new system has been seen in no particular more evidently than in the diminution of disease among the convicts.

"6. Religious instruction was one of the original remedies prescribed for the great moral disease, which the present penal system is calculated to cure. Divine service is generally peformed every Sunday, in a large room appropriated solely for the purpose. Some clergyman or pious layman volunteers his services, and discourses are delivered, suited to the situation and capacities of the audience. The prisoners in the cells are denied this indulgence; good books are likewise distributed among them.

"7. Corporal punishments are strictly prohibited, whatever offence may have been committed. The keepers carry no weapons, not even a stick. The solitary cells and low diet have on all occasions been found amply sufficient to bring down the most determined spirit, to tame the most hardened villain that ever entered them. Of the truth of this there are striking cases on record. Some veterans in vice, with whom it was necessary to be severe, have declared their preference of death by the gallows to a further continuance in that place of torment. In the cells, the construction of which renders conversation among those confined in them difficult, the miserable man is left to the greatest of all possible punishments, his own reflections. His food, which consists of only half a pound of bread per day, is given him in the morning; in the course of a few days or weeks, the very nature of the being is changed; and there is no instance of any one having given occasion for the infliction of the punishment a second time. Such is the impression which the reports of its effects have left among the convicts, that the very dread of it is sufficient to prevent the frequent commission of those crimes for which it is the known punishment, as swearing, impudence, rudeness, quarrelling, indolence repeated, or wilful injury to the tools, or to articles of manufacture.

"There are fourteen inspectors, three of whom are elected by the select and common councils in joint meeting, in May and November; two by the commissioners of the Northern Liberties, and two by the commissioners of Southwark, at the same time."

We extract the following account of the malignant fever which prevailed in Philadelphia in 1793 and 1797, from a pamphlet written by Mr Carey. "The symptoms which characterized the first stage of the fever were, in the greatest number of cases, after a chilly fit of some duration, a quick tense pulse; hot skin; pain in the head, back, and limbs; flushed countenance; inflamed eyes; moist tongue; oppression and sense of soreness at the stomach, especially upon pressure; frequent sick qualms, and retchings to vomit, without discharging any thing, except the contents last taken into the stomach; costiveness, &c.

"These symptoms generally continued with more or less violence from one to three, four, or even five days; and then gradually abating, left the patient free from every complaint, except general debility. On the febrile symptoms suddenly subsiding, they were immediately succeeded by a yellow tinge in the opaque cornea, or whites of the eyes; an increased oppression at the præcordia, a constant puking of every thing taken into the stomach, with much straining, accompanied with a hoarse hollow noise.

"If these symptoms were not soon relieved, a vomiting of matter resembling coffee-grounds in colour and consistence, commonly called the *black vomit*, sometimes accompanied with or succeeded by hemorrhagies from the nose, fauces, gums, and other parts of the body; a yellowish purple colour, and putrescent appearance of the whole body, hiccup, agitations, deep and distressed sighing, comatose delirium, and finally death, are the consequence. When the disease proved fatal, it was generally between the fifth and eighth days.

"This was the most usual progress of this formidable disease through its several stages. There were, however, very considerable variations in the symptoms as well as in the duration of its different stages, according, to the constitution and temperament of the patient, the state of the weather, the manner of treatment, &c.

"In some cases, signs of putrescency appeared at the beginning or before the end of the third day. In these, the black vomiting, which was generally a mortal symptom, and universal yellowness, appeared early. In these cases, also, a low delirium, and great prostration of strength, were constant symptoms, and coma came on very speedily. In other, the symptoms inclined more to the nervous than the inflammatory type."

PHILADELPHIA, an ancient town of Turkey in Asia, in Natolia. It is seated at the foot of Mount Tmolus, by the river Cogamus, from whence there is an exceeding fine view over an extensive plain. This place was founded by Attalus Philadelphus, brother of Eumenes.

It was very liable to earthquakes, which, perhaps, arose from its vicinity to the region called *Catakekaumene* *. So severe were those earthquakes, that even the city walls were not secure; and so frequent were they that these experienced daily concussions. The inhabitants, therefore, who were not numerous, lived in perpetual apprehension, and their constant employment was in repairs. In fact, so great were their fears, that their chief residence was in the country, the soil of which was very fertile. Such is Strabo's account of this place. In the year 1097, it was taken by assault by John Ducas the Greek general. It was without difficulty reduced also in the year 1106, under the same emperor. The Turks marched from the East with a design to plunder it and the maritime towns. The emperor Manuel, in 1175, retired for protection from the Turks to this place. In 1300, it fell by lot to Karaman. In 1306, it was besieged by Alifaras, and considerably harassed; but was not taken. In 1391, this place alone refused to admit Bajazet; but it was at length forced to capitulate for want of provisions. It has been matter of surprise that this town was not totally abandoned; and yet it has survived many cities less liable to inconveniences, and is still an extensive place, though in its appearance it is poor and mean. Some remnants of its walls are still standing, but with large gaps. The materials of the wall are small stones strongly cemented. It is thick, lofty, and has round towers. Near this place, between the mountains, there is a spring of a purgative quality; it is much esteemed, and many people resort to it in the hot months. It tastes like ink, is clear, but tinges the earth with the colour of ochre. The famous wall, which credulity has asserted to be made of human bones, stands beyond this and beyond the town. See the next article.

When Dr Chandler was there, he tells us, "The bishop of Philadelphia was absent; but the proto-papas or chief priest, his substitute, whom we went to vist, received us at his palace, a title given to a very indifferent house or rather a cottage of clay. We found him

Travels in Greece.

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* Signifying *the Burned.*

ignorant of the Greek tongue, and were forced to discourse with him by an interpreter in the Turkish language. He had no idea that Philadelphia existed before Christianity, but told us it had become a city in consequence of the many religious foundations. The number of churches he reckoned at 24, mostly in ruins, and mere masses of wall decorated with painted saints. Only six are in a better condition, and have their priests. The episcopal church is large, and ornamented with gilding, carving, and holy portraits. The Greeks are about 300 families, and live in a friendly intercourse with the Turks, of whom they speak well. We were assured that the clergy and laity in general knew as little of Greek as the proto-papas; and yet the liturgies and offices of the church are read as elsewhere, and have undergone no alteration on that account.

"The Philadelphians are a civil people. One of the Greeks sent us a small earthen vessel full of choice wine. Some families beneath the trees, by a rill of water, invited us to alight, and partake of their refreshments. They saluted us when we met; and the aga or governor, on hearing that we were Franks, bade us welcome by a messenger.

"Philadelphia possessing waters excellent in dyeing, and being situated on one of the most capital roads to Smyrna, is much frequented, especially by Armenian merchants. The Greeks still call this place by its ancient name, but the Turks call it *Allahijur*. The number of inhabitants is about 7000 or 8000; of whom 2000 are supposed to be Christians. It is about 40 miles E. S. E. of Smyrna. E. Long. 28. 15. N. Lat. 38. 28."

Philadelphia-Stones, a name which some authors have given to what is otherwise called *Christian bones*, found in the walls of that city. It is a vulgar error that these walls are built of bones; and the tradition of the country is, that when the Turks took the place, they fortified it for themselves, and built their walls of the bones of the Christians whom they had killed there. Dr Smyth in one of his epistles, mentions this wall as an instance of Turkish barbarity. This idle opinion has gained credit merely from a loose and porous stone of the sparry kind, found in an old aqueduct, which is still in the wall. Sir Paul Rycaut brought home pieces of these stones, which even he supposed to have been bones, but they proved on examination to be various bodies, chiefly vegetable, incrusted over and preserved in a spar of the nature of that which forms incrustations in Knaresborough spring, and other places with us. These bodies are often cemented together in considerable numbers by this matter, and their true shape lost in the congeries, till a diligent and judicious eye traces them regularly.

Philadelphian Society, in ecclesiastical history, an obscure and inconsiderable society of mystics. They were formed about the end of the last century by an English female fanatic, whose name was *Jane Leadley*, This woman seduced, by her visions, predictions, and doctrines, several disciples, among whom were persons of learning. She believed that all dissensions among Christians would cease, and the kingdom of the Redeemer become a scene of charity and felicity, if Christians, disregarding the forms of doctrine or discipline of their several communions, would all join in committing their souls to the care of the internal guide, to be instructed, governed, and formed, by his divine impulse and suggestions. But she went farther than this: she even pretended a divine commission to proclaim the approach of this glorious communion of saints; and was convinced that the society established by herself was the true kingdom of Christ. One of her leading doctrines was that of the final restoration of all intelligent beings to perfection and happiness.

PHILADELPHUS, in antiquity, was a title or surname borne by several ancient kings; formed from the Greek φιλος, "friend, lover," and αδελφος, "brother;" q. d. one who loves his brother or brethren. See Ptolemy and Egypt.

Philadelphus, the Pipe-tree, or *Mock-orange*; a genus of plants belonging to the icosandria class. See Botany *Index*.

The coronarius, white syringa, or mock-orange, has been long cultivated in the gardens of this country as a flowering shrub; it is not well known in what country it is to be found native. It rises seven or eight feet high; sending up a great number of slender stalks from the root. These have a grey bark, branch out from their sides, and are garnished with oval spear-shaped leaves. This shrub by its flowers makes a fine figure in May and June; for they are produced in clusters both at the end and from the sides of the branches. They are of a fine white colour, and exceedingly fragrant.

PHILÆNI, were two brothers, citizens of Carthage, who sacrificed their lives for the good of their country. At the time when the Carthaginians ruled over the greatest part of Africa, the Cyrenians were also a great and wealthy people. The country in the middle betwixt them was all sandy, and of an uniform appearance. There was neither river nor mountain to distinguish their limits; a circumstance which engaged them in a terrible and tedious war with one another. After their armies and fleets had been often routed and put to flight on both sides, and they had weakened one another pretty much; and fearing lest, by and by, some third people should fall upon the conquered and conquerors together, equally weakened, upon a cessation of arms they made an agreement, "that upon a day appointed deputies should set out from their respective homes, and the place where they met one another should be accounted the common boundary of both nations." Accordingly, the two brothers called Philæni, sent from Carthage, made all dispatch to perform their journey. The Cyrenians proceeded more slowly. These last, perceiving themselves a little behind, and becoming apprehensive of punishment at home for mismanaging the affair, charged the Carthaginians with setting out before the time; made a mighty bustle upon it; and, in short, would rather choose any thing than go away outdone. But whereas the Carthaginians desired any other terms, provided only they were fair, the Cyrenians made this proposal to the Carthaginians, "either to be buried alive in the place which they claimed as the boundary to their nation, or that they would advance forward to what place they inclined upon the same condition." The Philæni accepting the offer, made a sacrifice of themselves and their lives to their country, and so were buried alive. The Carthaginians dedicated altars in that place to the memory of the two brothers. These altars, called *Aræ Philænorum*, served as a boundary to the empire of the Carthaginians, which extended from this monument to Hercules's Pillars, which is about 2000 miles, or, according to the accurate observations of the moderns, only 1420 geographical miles. It is Sallust who gives this account in his history of the Jugurthine war.

PHILANTHROPY is compounded of two Greek words which signify the love of mankind. It is therefore of nearly the same import with *benevolence* (A); and differs from *friendship*, as this latter affection subsists only between a few individuals, whilst *philanthropy* comprehends the whole species.

Whether man has an instinctive propensity to love his species, which makes him incapable of happiness but in the midst of society, and impels him to do all the good that he can to others, feeling their felicity an addition to his own, is a question that has been warmly debated among philosophers ever since metaphysics was studied as a science. With the opinions of the ancients we shall not, in this detached article, trouble our readers; but it would be unpardonable to pass without notice the different theories which on so interesting a subject have divided the moderns.

Hobbes, who believed, or pretended to believe, that right results from power, and that in society there is no other standard of justice than the law of the land, or the will of the supreme magistrate, built his opinions upon a theory of human nature, in which philanthropy has no place. According to him, mankind, in the original state of nature, were wholly *selfish*. Each endeavoured to seize, by fraud or force, whatever he thought would contribute to his comfort; and as all had nearly the same wants, the inevitable consequence of this selfishness was universal war. We are taught indeed by the same philosopher, that, in a series of ages, mankind discovered the miseries of this state of nature; and therefore, upon the same basis of universal selfishness, formed societies, over which they placed supreme governors for the purpose of protecting the weak against the violence of the strong. He does not, however, explain how men, whose angry and selfish passions were thus excited to the utmost against each other, could enter upon this friendly treaty; or, supposing it formed, how the ignorant multitude were induced to pay obedience to the more enlightened few. Clogged with this and other insurmountable difficulties, his philosophy of human nature soon fell into merited contempt; but about the *origin* of philanthropy those who united in opposition to him still thought very differently from one another.

The elegant Shaftesbury, who had imbibed much of the spirit of Plato, endeavoured, like his master, to deduce all the duties of man, and almost all his actions, from a number of internal feelings or instincts which he supposed to be interwoven with his constitution by the immediate hand of God. This system appeared so honourable to human nature, and at the same time was so easily comprehended, that the noble lord had soon many followers, and may indeed be considered as the founder of a school which has produced philosophers whose works do honour to the age and country in which they flourished. Among these we must reckon Bishop Butler, Hutchison, Lord Kames, Dr Beattie, and perhaps Dr Reid.

According to the system of these writers, the whole duty of man results from an intuitive principle, to which they have given the name of the moral sense; and with this sense they conceive philanthropy to be inseparably united, or rather perhaps to make an essential part of it. (See MORAL PHILOSOPHY). If this theory be carried to its utmost extent, as it has been by some of its patrons, it seems to follow, that peace and harmony should reign among savages; and that a man who had from his infancy grown up in solitude, would be delighted with the first sight of a fellow-creature, and run to him with eagerness as to a new source of enjoyment. This conclusion, however, is contrary to acknowledged facts. Savages are generally divided into small tribes or hordes; and though the attachment of individuals to their own tribe appears indeed to be abundantly strong, the tribes themselves are frequently at war, and entertain a constant jealousy of each other. Savages, too, are almost universally afraid of strangers; and the few solitary individuals, who have been caught in parts where they had run wild from their infancy, instead of being delighted with the appearance of fellow-men, have either fled from them with their utmost speed, or been fixed to the spot in terror and astonishment. These are no indications of that instinctive philanthropy for which some writers so strenuously plead. They have indeed induced others to deny, that in human nature there is any instinctive principles at all; and to endeavour to account for our several propensities by the influence of education producing early and deep-rooted habits.

At the head of this school stood Locke and Hartley. The former, employing himself almost wholly on the intellectual powers of man, and combating the absurd, though then generally received, belief, that there are in the human mind innate principles of speculative truth, has touched but incidentally on our principles of action. It seems, however, to be evident that he did not consider any *one* of these principles as innate; and his opinion was adopted by Hartley, who studied the sensitive part of human nature with greater industry and success than perhaps any writer who had preceded him in that department of science. This philosopher refuses all kind of instinct to man, even the στοργη of a mother to her new-born infant, and that which has been generally supposed innate—the propensity of the infant to suck the breast. It is therefore needless to say that in his theory of human nature innate philanthropy can have no place.

The reader, however, must not suppose that the theory of Hartley is the theory of Hobbes. Though he admits no *innate* principles of action in the human mind, he is far from dreaming that the original state of man was a state of war and selfishness, or that the acquisition of philanthropic sentiments is not natural. He considers such

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(A) We say *nearly* of the same import; because *benevolence* extends to every being that has life and sense, and is of course susceptible of pain and pleasure; whereas *philanthropy* cannot comprehend more than the human race.

such acquisitions as even necessary and unavoidable, and founds them on the great law of association, which we have elsewhere endeavoured to explain. (See METAPHYSICS, Part I. chap. v.). Hartley was a Christian, and appears to have been a man of great piety. Conceiving with Locke that men are born without any ideas, or any principles either of knowledge or of action, but that they are subject to the law of association as much as to the impressions of sense, he seems to have thought, that the important purpose for which they are sent into this world is, that they may acquire habits of piety and virtue, which, operating like instincts, will fit them for the purer society of a future state. That this theory is unfriendly to morals, no man who understands it will presume to affirm. It appears, indeed, to be more consistent with the necessity of a revelation from God than that of Shaftesbury, which has so many followers: but notwithstanding this, we cannot help thinking that the excellent author has carried his antipathy to instincts by much too far (see INSTINCT), and that the truth lies in the middle between him and his opponents.

Without some instincts to influence before the dawn of reason, it is not easy to be conceived how children could be induced to that exercise which is absolutely necessary to life and health; nor does it appear with sufficient evidence that the human race are deserted by every instinct as soon as their rational powers are evolved. It seems to be a matter of fact which cannot be controverted, that women have an instinctive attachment to their new-born infants; but that these, when they become capable of distinguishing objects, are *instinctively* attached to their parents, their brothers, and sisters, is a position which, though it may be true, seems incapable of proof. That they soon appear to be so attached, is a fact which we believe no man will deny; but the attachment may be accounted for by the associating principle operating upon that desire of happiness which is necessarily formed as soon as happiness is experienced. (See PASSION). An infant becomes earlier attached to its nurse than to any other person; because, feeling wants which she supplies, the idea of enjoyment becomes soon associated in its mind with the perception of the woman. If this woman be its mother, a hasty observer immediately attributes this attachment to instinct directing the infant to love its parent; but that instinct has here no place, is evident from the well-known facts, that a child is as fond of a tender nurse, though no relation, as of the most affectionate mother; and as regardless of a mother who seldom sees it, or sees it with indifference, as of any other person. Nay, we have seen children of the sweetest dispositions as fond of the maid with whom they slept, as of a very affectionate parent by whom they had been tenderly nursed: and sure no man will say that this could be instinct; it was evidently a new association of the idea of the maid with the greatest happiness which they enjoyed after the period of their suckling was at an end.

It is much in the same way that children acquire an attachment to their brothers and sisters. Brothers and sisters being constantly together, contribute to each other's amusement: hence arises that pleasure which they have in each other's company, and the uneasiness which they feel when separated. This generates mutual love in their minds, which is strengthened by the perpetual injunctions of their parents; for if these have any virtue themselves, they cannot fail to inculcate the duty of loving each other on their tender offspring. Benevolence, thus generated, soon extends to their daily companions; and takes a wider and a wider range as these companions are multiplied, and as children advance towards the state of manhood. New objects then present themselves to the mind. A man soon discovers, that, as he is a member of a community, his happiness as an individual depends in a great measure on the prosperity of the whole. Hence arises *patriotism*, and that pleasure which we all take in the eminence of our countrymen. But the principle of benevolence stops not here. He whose mind is enlarged by a liberal education, considers all particular countries as provinces of one great country extended over the whole globe; and all mankind, of course, as not only sharing the same nature with himself, but as being in reality his fellow-citizens and brethren. The principles of religion, if he be actuated by them, must aid these reflections, and make him wish the happiness of all who stand in the same relation with himself to the Great Governor of the world. This is *philanthropy;* and we see how it may spring, by the great law of association, from desires which, in their original state, cannot be considered as other than selfish. It is a calm sentiment, which we believe hardly ever rises to the warmth of affection, and certainly not to the heat of passion.

Should any of our readers be disposed to controvert this opinion, or to fancy it degrading to human nature, we will not enter into controversy with them; we only beg leave to ask, whether they have ever rejoiced in the good fortune of a stranger or a foreigner, or regretted his loss, with any portion of those feelings which they have frequently experienced on hearing of the prosperity or the death of a friend or a neighbour? We answer candidly for ourselves, that we feel no interest which can be called *passion* or *affection* in the fortunes of a native of China; and yet we should be sorry to think that our philanthropy is less than that of other men. A common clown, we are inclined to believe, seldom extends his affection beyond his friends and neighbours; and though, from having often heard his country praised, and knowing that he belongs to his country, he would probably be offended at the man who should prefer another to it; yet if no misfortune befal him, or his friends and neighbours, we imagine that his grief for public calamities may be borne with patience. In his mind no such associations have been formed as comprise the good of a country, far less of all countries; and therefore his philanthropy must be confined to a very limited range. We doubt not, however, but that as opportunity offers, and as circumstances permit, such a man is ready to feed the hungry and clothe the naked of all countries; not indeed from sentiments of affection either innate or acquired, but from the obvious reflection that he is not exempted from those calamities which have befallen them, and from a still higher principle—a sense of duty to that God who has made of one blood all nations upon earth, and commanded them to be mutually aiding to each other.

PHILEMON, a Greek comic poet, was son to Damon, and cotemporary with Menander. Any advantage he had over this poet, was owing less to his own merit than to the intrigues of his friends. Plautus has imitated his comedy *du Marchand*. He is reported to have died laughing on seeing his ass eat figs. He was then about 97 years of age. His son Philemon the younger, was also the author of 54 comedies, of which there are still extant some considerable fragments collected by Grotius. These clearly prove that he was not a poet of the first rank. He flourished about the year 274 before our Saviour.

PHILEMON, was a rich citizen of Colossæ in Phrygia. He was converted to the Christian faith, with Appia his wife, by Epaphras the disciple of St Paul; for St Paul himself did not preach at Colossæ, Colloss. ii. 1. Perhaps we should have known nothing of St Philemon, had it not been on the account of his slave Onesimus, who having robbed him, and run away from him, came to Rome, where he found St Paul, and was very serviceable to him. St Paul converted him, baptized him, and sent him back to his master Philemon; to whom he wrote a letter still extant, and which passes for a masterpiece of that kind of eloquence, natural, lively, strong, and pathetic, that was peculiar to St Paul. Philemon (1. 2.) had made a church of his house, and all his domestics, as well as himself, were of the household of faith. His charity, liberality, and compassion, were a sure refuge to all that were in distress. The Apostolical Constitutions say, that St Paul made him bishop of Colossæ; but the Menæa insinuate, that he went to Gaza in Palestine, of which he was the apostle and first bishop. From hence he returned to Colossæ, where he suffered martyrdom with Appia his wife, in the time of Nero. They relate several particulars of his martyrdom, and say, that his body remained at Colossæ, where it performed several miracles.

PHILETAS, a Greek poet and grammarian, of the island of Cos, flourished under Philip and Alexander the Great, and was preceptor of Ptolemy Philadelphus. He was the author of some Elegies, Epigrams, and other works, which have not come down to us. He is celebrated in the poems of Ovid and Propertius, as one of the best poets of his age. Elian reports a very improbable story of him, namely, "that his body was so slender and feeble, that he was obliged to have some lead in his pockets, to prevent him from being carried away by the wind."

PHILETUS. St Paul, writing to Timothy (2 Tim. ii. 16, 17, 18.) in the 65th year of Christ, and a little while before his own martyrdom, speaks thus: "But shun profane and vain babblings, for they will increase unto more ungodliness. And their word will eat as doth a canker; of whom is Hymenæus and Philetus; who concerning the truth have erred, saying, that the resurrection is past already, and overthrow the faith of some." We have nothing very certain concerning Philetus; for we make but small account of what is read in the false Abdias, in the life of St James major, even supposing this author had not put the name of Philetus instead of Phygellus. This is the substance of what is found in Abdias. St James the son of Zebedee, passing through the synagogues of Judea and Samaria, preached everywhere the faith of Jesus Christ. Hermogenes and Philetus strenuously opposed him, affirming, that Jesus Christ was not the Messiah. Hermogenes was a notable magician, and Philetus was his disciple, who being converted, was desirous to bring his master to St James; but Hermogenes bound him up so by his magic art, that he could not come at the apostle. Philetus found means to make St James acquainted with what had happened to him; upon which St James unbound him, and Philetus came to him. Hermogenes perceiving how ineffectual his art was against the saint, became himself a convert as well as Philetus.

PHILIBEG, is a little plaid, called also *kilt*, and is a sort of short petticoat reaching nearly to the knees, worn by the Scotch Highlanders. It is a modern substitute for the lower part of the plaid, being found to be less cumbersome, especially in time of action, when the Highlanders used to tuck their brechdan into their girdle. Almost all of them have a great pouch of badger and other skins, with tassels dangling before, in which they keep their tobacco and money.

PHILIP, foster-brother of Antiochus Epiphanes (1 Macc. vi. 14, & 55. 2 Macc. ix. 29.), was a Phrygian by birth, and very much in Antiochus's favour. This prince made him governor of Jerusalem (2 Macc. viii. 8. v. 22.) where he committed many outrages upon the Jews, to force them to forsake their religion. Seeing that Apollonius and Seron were defeated by Judas Maccabæus, he sent for new succours to Ptolemy governor of Cœlo-Syria, who sent him Gorgias and Nicanor with a powerful army. Some time after, Antiochus going beyond the Euphrates, to extort money from the people, Philip went along with him; and Antiochus finding himself near his end (1 Macc. vi. 14.) made him regent of that kingdom, put his diadem into his hands, his royal cloak, and his ring, that he might render them to his son the young Antiochus Eupator. But Lysias having taken possession of the government in the name of young Eupator, who was but a child, Philip not being able to cope with him, durst not return into Syria: but he went into Egypt, carrying the body of Epiphanes along with him, there to implore assistance from Ptolemy Philometor against Lysias the usurper of the government of Syria. The year following, while Lysias was busy in the war carrying on against the Jews, Philip got into Syria, and took possession of Antioch: but Lysias returning into the country, with great diligence, retook Antioch, and put Philip to death, who was taken in the city.

PHILIP the apostle was a native of Bethsaida in Galilee. Jesus Christ having seen him, said to him, "Follow me," John i. 43, 44, &c. Philip followed him; and soon after finding Nathanael, Philip said to him, "We have found the Messiah, of whom Moses and the prophets have spoken, Jesus of Nazareth, the son of Joseph." Nathanael asked him, "Can any thing good come out of Nazareth?" To which Philip replied, "Come and see." Then he brought Nathanael to Jesus, and they went with him to the marriage of Cana in Galilee. St Philip was called at the very beginning of our Saviour's mission; and when Jesus Christ was about to feed the 5000 that followed him (Luke vi. 13. Mat. x. 2. John vi. 5—7.), he asked St Philip, only to prove him, whence bread might be bought for such a multitude of people? Philip answered, that 200 pennyworth of bread would not be sufficient for every one to taste a little. Some Gentiles, having a curiosity to see Jesus Christ, a little before his passion, they addressed themselves to St Philip (John xii. 21, 22), who mentioned it to St Andrew, and these two to Christ. At the last supper, Philip desired our Saviour, that he would be pleased to show them the Father, being all that they desired (John xiv. 8—10.) But Jesus told them, that seeing the Son they saw the

Father also. This is all we find concerning Philip in the gospel.

The upper Asia fell to this apostle's lot, where he took great pains in planting the gospel, and by his preaching and miracles made many converts. In the latter part of his life, he came to Hierapolis in Phrygia, a city very much addicted to idolatry, and particularly to the worship of a serpent of a prodigious bigness. St Philip by his prayers procured the death, or at least the disappearing, of this monster, and convinced its worshippers of the absurdity of paying divine honours to such odious creatures. But the magistrates, enraged at Philip's success, imprisoned him, and ordered him to be severely scourged, and then put to death, which some say was by crucifixion; others, by hanging him up against a pillar. St Philip is generally reckoned among the married apostles; and it is said he had three daughters, two whereof preserved their virginity, and died at Hierapolis: the third, having led a very spiritual life, died at Ephesus. He left behind him no writings. The gospel under his name was forged by the Gnostics, to countenance their bad principles and worse practices. The Christian church observes the festival of this saint, together with that of St James, on the first day of May. Euseb. lib. iii. c. 30.

Philip, the second of the seven deacons, was chosen by the apostles after our Saviour's resurrection. (Acts vi. 5.). This deacon, they say, was of Cæsarea in Palestine. It is certain that his daughters lived in this city (Acts xxi. 8, 9.). After the death of St Stephen, all the Christians, excepting the apostles, having left Jerusalem, and being dispersed in several places, St Philip went to preach at Samaria (*id.* viii. 1, 2, &c.), where he performed several miracles, and converted many persons. He baptized them; but being only a deacon, he could not confer on them the Holy Ghost. Wherefore having made known to the apostles at Jerusalem, that Samaria had received the word of God, Peter and John came thither, and the Samaritans that were converted received the Holy Ghost. St Philip was probably at Samaria when the angel of the Lord ordered him to go to the south part of the country, in the road that leads from Jerusalem to old Gaza. Philip obeyed, and there met with an Ethiopian eunuch belonging to Queen Candace, who had the care of her revenues, and had been at Jerusalem to worship God there (*id.* viii. 26, 27, &c.). He was then returning into his own country, and was reading the prophet Isaiah as he went along in his chariot. Philip, hearing the eunuch reading the prophet Isaiah, said to him, Do you understand what you read? The eunuch replied, How should I understand, except somebody explain it to me? He desired Philip therefore to come and sit down by him in the chariot. The passage the eunuch was reading is this: "He was led as a sheep to the slaughter, and like a lamb dumb before his shearer, so he opened not his mouth." The eunuch then says to Philip, Pray, whom does the prophet speak of in this place? Is it of himself, or of some other? Then Philip began to instruct him concerning Jesus Christ. And having gone on together, they came to a fountain; when the eunuch said to Philip, Here is water, what hinders me from being baptized? Philip told him that he might be so, if he believed with all his heart. He replied, I believe that Jesus Christ is the son of God. He then ordered the chariot to stop, and they both alighted and went down into the water, where Philip baptized the eunuch. Being come out of the water, the Spirit of the Lord took away Philip, and the eunuch saw no more of him. But Philip was found again at Azotus, and he preached the gospel in all the cities he passed through, till he arrived at Cæsarea in Palestine. After this, the scripture does not inform us of any particulars relating to Philip. The modern Greeks say that he went to Tralles in Asia, where he founded a church, of which he was the apostle and bishop; and where he rested in peace, after performing many miracles. The Latins, on the contrary, say that he died at Cæsarea, and that three of his daughters were there buried with him.

It is thought, that the eunuch converted by St Philip was the first apostle of the Ethiopians; and that the Abyssines boast of having received the Christian faith from him.

Lempriere's Bibliotheca Classica.

Philip II. was the fourth son of Amyntas, king of Macedonia. He was sent to Thebes as an hostage by his father, where he learnt the art of war under Epaminondas, and studied with the greatest care the manners and the pursuits of the Greeks. He discovered, from his earliest years, that quickness of genius and greatness of courage which afterwards procured him so great a name and such powerful enemies. He was recalled to Macedonia; and at the death of his brother Perdiccas he ascended the throne as guardian and protector of the youthful years of his nephew. His ambition, however, soon discovered itself, and he made himself independent about the year 360 before Christ. The valour of a prudent general, and the policy of an experienced statesman, seemed requisite to ensure his power. The neighbouring nations, ridiculing the youth and inexperience of the new king of Macedonia, appeared in arms; but Philip soon convinced them of their error. Unable to meet them as yet in the field of battle, he suspended their fury by presents, and soon turned his arms against Amphipolis, a colony tributary to the Athenians. Amphipolis was conquered, and added to the kingdom of Macedonia; and Philip meditated no less than the destruction of a republic which had rendered itself so formidable to the rest of Greece, and had even claimed submission from the princes of Macedonia. His designs, however, were as yet immature; and before he could make Athens an object of conquest, the Thracians and the Illyrians demanded his attention. He made himself master of a Thracian colony, to which he gave the name of *Philippi*, and from which he received the greatest advantages on account of the gold mines in the neighbourhood. These made it a very important capture. He settled in it a number of workmen, and was the first who caused gold to be coined in his own name. He employed his wealth in procuring spies and partisans in all the great cities of Greece, and in making conquests without the aid of arms. It was at the siege of Methone in Thrace that Philip had the misfortune to receive a wound in his right eye from the stroke of an arrow. In the midst of his political prosperity, Philip did not neglect the honour of his family. He married Olympias the daughter of Neoptolemus, king of the Molossi; and when, some time after, he became father of Alexander, the monarch, conscious of the inestimable advantages which arise from the lessons, the example, and conversation of a learned and virtuous preceptor, wrote a letter with his own hand to the philosopher Aristotle, and begged him to retire from his usual pursuits, and to dedicate his whole time to the instruction of the young prince. Every thing seemed now to conspire to his aggrandizement; and historians have observed that Philip received in one day the intelligence of three things which could gratify the most unbounded ambition, and flatter the hopes of the most aspiring monarch: the birth of a son, an honourable crown at the Olympic games, and a victory over the barbarians of Illyricum. But all these rather increased than satiated his ambition: he declared his inimical sentiments against the power of Athens, and the independence of all Greece, by laying siege to Olynthus, a place which, on account of its situation and consequence, would prove most injurious to the interests of the Athenians, and most advantageous to the intrigues and military operations of every Macedonian prince. The Athenians roused by the eloquence of Demosthenes, sent 17 vessels and 2000 men to the assistance of Olynthus; but the money of Philip prevailed over all their efforts. The greatest part of the citizens suffered themselves to be bribed by the Macedonian gold, and Olynthus surrendered to the enemy, and was instantly reduced to ruins. Philip soon after defeated the Athenians, and made a greater number of them prisoners, whom he dismissed without ransom. Of this victory, the fruit of that excellent discipline which he had established in his army, the Macedonian phalanx had the principal honour. This was a body of infantry heavily armed, consisting commonly of 16,000 men, who had each of them a shield six feet high and a pike 21 feet long. (See PHALANX). The success of his arms, and especially his generosity after victory, made his alliance and a peace a desirable object to the people of Athens; and as both parties were inclined to this measure, it was concluded without delay. His successes were as great in every part of Greece: he was declared head of the Amphictyonic council, and was entrusted with the care of the sacred temple of Apollo at Delphi. If he was recalled to Macedonia, it was only to add fresh laurels to his crown, by victories over his enemies in Illyricum and Thessaly. By assuming the mask of a moderator and peace-maker, he gained confidence; and in attempting to protect the Peloponnesians against the encroaching power of Sparta, he rendered his cause popular; and by ridiculing the insults that were offered to his person as he passed through Corinth, he displayed to the world his moderation and philosophic virtues. In his attempts to make himself master of Eubœa, Philip was unsuccessful; and Phocion, who despised his gold as well as his meanness, obliged him to evacuate an island whose inhabitants were as insensible to the charms of money as they were unmoved at the horrors of war, and the bold efforts of a vigilant enemy. From Eubœa he turned his arms against the Scythians; but the advantages he obtained over this indigent nation were inconsiderable, and he again made Greece an object of plunder and rapine. He advanced far in Bœotia, and a general engagement was fought at Chæronea. The fight was long and bloody, but Philip obtained the victory. His behaviour after the battle reflects great disgrace upon him as a man and as a monarch. In the hour of festivity, and during the entertainment which he had given to celebrate the trophies he had won, Philip sallied from his camp, and with the inhumanity of a brute, he insulted the bodies of the slain, and exulted over the calamities of the prisoners of war. His insolence, however, was checked, when Demades, one of the Athenian captives, reminded him of his meanness, by exclaiming, "Why do you, O king, act the part of a Thersites, when you can represent with so much dignity the elevated character of an Agamemnon?" The reproof was felt; Demades received his liberty; and Philip learned how to gain popularity even among his fallen enemies; by relieving their wants and easing their distresses. At the battle of Chæronea the independence of Greece was extinguished; and Philip, unable to find new enemies in Europe, formed new enterprises, and meditated new conquests. He was nominated general of the Greeks against the Persians, and was called upon, as well from inclination as duty, to revenge those injuries which Greece had suffered from the invasions of Darius and Xerxes. But he was stopped in the midst of his warlike preparations, being stabbed by Pausanias as he entered the theatre at the celebration of the nuptials of his daughter Cleopatra. This murder has given rise to many reflections upon the causes which produced it; and many who consider the recent repudiation of Olympias and the resentment of Alexander, are apt to investigate the causes of his death in the bosom of his family. The ridiculous honours which Olympias paid to her husband's murderer strengthened the suspicion; yet Alexander declared that he invaded the kingdom of Persia to revenge his father's death upon the Persian satraps and princes, by whose immediate intrigues the assassition had been committed. The character of Philip is that of a sagacious, artful, prudent, and intriguing monarch: he was brave in the field of battle, eloquent and dissimulating at home, and he possessed the wonderful art of changing his conduct according to the disposition and caprice of mankind, without ever altering his purpose, or losing sight of his ambitious aims. He possessed much perseverance, and in the execution of his plans he was always vigorous. He had that eloquence which is inspired by strong passions. The hand of an assassin prevented him from achieving the boldest and the most extensive of his undertakings; and he might have acquired as many laurels, and conquered as many nations, as his son Alexander did in the succeeding reign; and the kingdom of Persia might have been added to the Macedonian empire, perhaps with greater moderation, with more glory, and with more lasting advantages. The private character of Philip lies open to censure, and raises indignation. The admirer of his virtues is disgusted to find him among the most abandoned prostitutes, and disgracing himself by the most unnatural crimes and lascivious indulgencies which can make even the most debauched and the most profligate to blush. He was murdered in the 47th year of his age, and the 24th of his reign, about 336 years before the Christian era. His reign is become uncommonly interesting, and his administration a matter of instruction. He is the first monarch whose life and actions are described with peculiar accuracy and historical faithfulness. Philip was the father of Alexander the Great and of Cleopatra, by Olympias; he had also by Audaca an Illyrian, Cyna, who married Amyntas the son of Perdiccas, Philip's elder brother; by Nicasipolis a Thessalian, Nicæa, who married Cassander; by Philæna a

Larissæan dancer, Aridæus, who reigned some time after Alexander's death; by Cleopatra, the niece of Attalus, Caranus and Europa, who were both murdered by Olympias; and Ptolemy the first king of Egypt, by Arsinoe, who in the first month of her pregnancy was married to Lagus. Of the many memorable actions and sayings reported by Plutarch of this prince, the following are the most remarkable. Being present at the sale of some captives, in an indecent posture, one of them informed him of it; "Set this man at liberty (says Philip), I did not know that he was my friend." Being solicited to favour a lord of his court, who was like to lose his character by a just but severe sentence, Philip refused to hearken to the solicitation, and added, "I had rather that he be disgraced than myself." A poor woman was importuning him to do her justice; and as he sent her away from day to day, under the pretence that he had no time to attend to her petition, she said to him with some warmth, "Cease then to be a king." Philip felt all the force of this reproof, and immediately gave her satisfaction.—Another woman came to ask justice of him as he was going out from a great entertainment, and was condemned. "I appeal (exclaimed she)!" "And to whom do you appeal (said the king to her)?" "To Philip fasting." This answer opened the eyes of the monarch, who retracted his sentence. If he possessed any virtue, it was principally that of suffering injuries with patience. Demochares, to whom the Greeks gave the surname of *Parrhesiastes*, on account of his excessive petulance of tongue, was one of the deputies whom the Athenians sent to this monarch. Philip, at the conclusion of the audience, begged the ambassadors to tell him, "if he could be of any service to the Athenians;" to which Demochares gave an insolent return, which he forgave. Having learned that some Athenian ambassadors charged him, in full assembly, with atrocious calumnies: "I am under great obligations (said he) to those gentlemen, for I shall henceforwards be so circumspect in my words and actions, that I shall convict them of falsehood." One saying of Philip, which does him less honour than those we have before mentioned, was, "Let us amuse children with playthings, and men with oaths." This abominable maxim, which was the soul and spring of his politics, gave rise to the observation, "That he was in full length, what Louis XI. afterwards was in miniature." It is well known that Philip had a person about him, who called out at times, "Philip, remember that thou art mortal;" but whether we should place this to the account of his pride or his humility, it is difficult to say.

Ibid. PHILIP V. was king of Macedonia, and son of Demetrius. His infancy, at the death of his father, was protected by Antigonus, one of his friends, who ascended the throne, and reigned for 12 years, with the title of *Independent monarch.* When Antigonus died, Philip recovered his father's throne, though only 15 years of age, and he early distinguished himself by his boldness and his ambitious views. He came to the throne in the year 220 before our Saviour, and the beginning of his reign was rendered glorious by the conquests of Aratus; a general who was as eminent for his love of justice as his skill in war. But so virtuous a character could hardly fail to be disagreeable to a prince who wanted to indulge himself in every species of dissipation and vice: and indeed his cruelty to him soon displayed his character in its true light; for to the gratification of every vice, and every extravagant propensity he had the meanness to sacrifice this faithful and virtuous Athenian. Not satisfied with the kingdom of Macedonia, Philip aspired to become the friend of Hannibal, and wished to share with him the spoils which the distresses and continual loss of the Romans seemed soon to promise. But his expectations were frustrated; the Romans discovered his intrigues; and though weakened by the valour and artifice of the Carthaginian, yet they were soon enabled to meet him in the field of battle. The consul Lævinus entered without delay his territories of Macedonia; and after he had obtained a victory over him near Apollonia, and reduced his fleet to ashes, he compelled him to sue for peace. This peaceful disposition was not permanent; and when the Romans discovered that he had assisted their formidable enemy Hannibal with men and money, they appointed T. Q. Flaminius to punish his perfidy, and the violation of the treaty. The Roman consul, with his usual expedition, invaded Macedonia; and in a general engagement, which was fought near Cynocephale, the hostile army was totally defeated, and the monarch saved his life with difficulty by flying from the field of battle. Destitute of resources, without friends either at home or abroad, Philip was obliged to submit to the mercy of the conqueror, and to demand peace by his ambassadors. It was granted with difficulty; the terms were humiliating; but the poverty of Philip obliged him to accept the conditions, however disadvantageous and degrading to his dignity. In the midst of these public calamities, the peace of his family was disturbed; and Perses, the eldest of his sons by a concubine, raised seditions against his brother Demetrius, whose condescension and humanity had gained popularity among the Macedonians, and who from his residence at Rome, as an hostage, had gained the good graces of the senate, and by the modesty and innocence of his manners had obtained forgiveness from that venerable body for the hostilities of his father. Philip listened with too much avidity to the false accusations of Perses; and when he heard it asserted that Demetrius wished to rob him of his crown, he no longer hesitated to punish with death so unworthy and so ungrateful a son. No sooner was Demetrius sacrificed to credulity, than Philip became convinced of his cruelty and rashness; and to punish the perfidy of Perses, he attempted to make Antigonus, another son, his successor on the Macedonian throne. But he was prevented from executing his purpose by death, in the 42d year of his reign, 178 years before the Christian era. The assassin of Demetrius succeeded his father, and with the same ambition, with the same rashness and oppression, renewed the war against the Romans, till his empire was destroyed, and Macedonia became a Roman province. Philip has been compared with his great ancestor of the same name; but though they possessed the same virtues, the same ambition, and were tainted with the same vices, yet the father of Alexander was more sagacious and more intriguing, and the son of Demetrius was more suspicious, more cruel, and more implacable; and, according to the pretended prophecy of one of the Sybils, Macedonia was indebted to one Philip for her rise and consequence among nations, and under another Philip she lamented the loss of her power, her empire, and her dignity.

Ibid. Philip, *M. Julius*, a Roman emperor, of an obscure family in Arabia, from whence he was surnamed *Arabian*. From the lowest rank in the army he gradually rose to the highest offices; and when he was made general of the prætorian guards, he assassinated Gordian, to make himself emperor. To secure himself on the imperial throne, he left Mesopotamia a prey to the continual invasions of the Persians, and hurried to Rome, where his election was universally approved by the senate and the Roman people. Philip rendered his cause popular by his liberality and profusion; and it added much to his splendour and dignity, that the Romans during his reign commemorated the foundation of their city; a solemnity which was observed but once every 100 years, and which was celebrated with more pomp and more magnificence than under the preceding reigns. The people were entertained with games and spectacles; the theatre of Pompey was successively crowded during three days and three nights; and 2000 gladiators bled in the circus at once, for the amusement and pleasure of a gazing populace. His usurpation, however, was short. Philip was defeated by Decius, who had proclaimed himself emperor in Pannonia; and he was assassinated by his own soldiers near Verona, in the 45th year of his age, and the 5th of his reign. His son, who bore the same name, and who had shared with him the imperial dignity, was also massacred in the arms of his mother. Young Philip was then in the 12th year of his age, and the Romans lamented in him the loss of rising talents, of natural humanity, and endearing virtues.

Ibid. Philip, a native of Acarnania, physician to Alexander the Great. When that monarch had been suddenly taken ill, after bathing in the Cydnus, Philip undertook to remove the complaint, when the rest of the physicians believed that all medical assistance would be ineffectual. But as he was preparing his medicine, Alexander received a letter from Parmenio, in which he was advised to beware of his physician Philip, as he had conspired against his life. The monarch was alarmed; and when Philip presented him the medicine, he gave him Parmenio's letter to peruse, and began to drink the potion. The serenity and composure of Philip's countenance, as he read the letter, removed every suspicion from Alexander's breast, and he pursued the directions of his physician, and in a few days recovered.

There were, besides, a vast number of persons of this name in antiquity, and many of them were very eminent.

Philip I. king of France, succeeded his father Henry I. in 1060, when but eight years of age, under the regency and guardianship of Baudouin V. count of Flanders, who discharged his trust with zeal and fidelity. He defeated the Gascons who were inclined to revolt, and died, leaving his pupil 15 years of age. This young prince made war in Flanders against Robert, Baudouin's younger son, who had invaded Flanders, which belonged to the children of his elder brother. Philip marched against him with a numerous army, which was cut to pieces near Mount Cassel. Peace was the consequence of the victory, and the conqueror quietly enjoyed his usurpation. Philip, after the fatigues of the war, by way of relaxation gave himself up entirely to pleasure and dissipation. Tired of his wife Bertha, and fond of Bertrade, spouse of Foulques count of Anjou, he carried her off from her husband. Having, in 1093, legally annulled his own marriage under the pretext of barrenness, and Bertrade's marriage with the count of Anjou having been set aside under the same pretext, Philip and she were afterwards solemnly married by the bishop of Beauvais. This union was declared void by Pope Urban II. a Frenchman by birth, who pronounced the sentence in the king's own dominions, to which he had come for an asylum. Philip, fearing that the anathemas of the Roman pontiff might be the means of exciting his subjects to rebellion, sent deputies to the pope, who obtained a delay, during which time he was permitted to use the crown. To know what is meant by this permission, it is necessary to recollect, that at that period kings appeared on public solemnities in royal habit, with the crown on their heads, which they received from the hand of a bishop. This delay was not of long duration. Philip was excommunicated anew in a council held at Poictiers in 1100; but in the year 1104, Lambert bishop of Arras, legate of Pope Pascal II. at last brought him his absolution to Paris, after having made him promise never to see Bertrade more; a promise which he did not keep. It would appear that the pope afterwards approved their marriage; for Suger informs us, that their sons were declared capable of succeeding to the crown. Philip died at Melun the 29th of July 1108, aged 57 years, after having witnessed the first crusade, in which he declined taking any part. His reign, which comprehends a period of 48 years, was the longest of any of his predecessors, excepting that of Clotarius, and of all who came after him, except those of Louis XIV. and Louis XV. It was distinguished by several great events; but Philip though brave in battle, and wise in counsels, was no very excellent character. He appeared so much the more contemptible to his subjects, as that age abounded with heroes. Philip is not the first of the French monarchs (as is commonly reported), who, in order to give the greater authority to his charters, caused them to be subscribed by the officers of the crown; for Henry I. had sometimes done the same before him.

Philip II. surnamed *Augustus*, the *conqueror and given of God*, son of Louis VII. (called the *younger*), king of France, and of Alix, his third wife, daughter of Thibault, count of Champagne, was born the 22d of August 1165. He came to the crown, after his father's death in 1180, at the age of 15 years. His youth was not spent like that of the generality of other princes; for, by avoiding the rock of pleasure on which so many are apt to split, his courage thereby became the more lively and intrepid. The king of England seemed willing to take advantage of his minority, and to seize upon a part of his dominions. But Philip marched against him, and compelled him, sword in hand, to confirm the ancient treaties between the two kingdoms. As soon as the war was ended, he made his people enjoy the blessings of peace. He gave a check to the oppressions of the great lords, banished the comedians, punished blasphemies, caused the streets and public places of Paris to be paved, and annexed to that capital a part of the adjacent villages. It was enclosed by walls with towers;

and the inhabitants of other cities were equally proud to fortify and embellish theirs. The Jews having for a long time practised the most shameful frauds in France, Philip expelled them from his kingdom, and declared his subjects quit with them; an action unjust, contrary to the laws of nature, and consequently to religion. The tranquillity of France was somewhat disturbed by a difference with the count of Flanders, which was however happily terminated in 1184. Some time after he declared war against Henry II. king of England, and took from him the towns of Issoudun, Tours, Mans, and other places. The epidemical madness of the crusades then agitated all Europe; and Philip, as well as other princes, caught the infection. He embarked in the year 1190, with Richard I. king of England, for the relief of the Christians in Palestine, who were oppressed by Saladin. Those two monarchs sat down before Acre, which is the ancient Ptolemais; as did almost all the Christians of the east, while Saladin was engaged in a civil war on the banks of the Euphrates. When the two European monarchs had joined their forces to those of the Asiatic Christians, they counted above 300,000 fighting men, Acre surrendered the 13th of July 1191; but the unhappy disagreement which took place between Philip and Richard, rivals of glory and of interest, did more mischief than could be compensated by the successful exertions of those 300,000 men. Philip, tired of these divisions, and displeased with the behaviour of Richard his vassal, returned to his own country, which, perhaps, he should never have left, or at least have seen again with more glory. Besides, he was attacked (say historians) with a languishing disorder, the effects of which were attributed to poison; but which might have been occasioned merely by the scorching heat of a climate so different from that of France. He lost his hair, his beard, and his nails; nay, his very flesh came off. The physicians urged him to return home; and he soon determined to follow their advice. The year after, he obliged Baudouin VIII. count of Flanders to leave him the county of Artois. He next turned his arms against Richard king of England, from whom he took Evreux and Vexin; though he had promised upon the holy gospels never to take any advantage of his rival during his absence; so that the consequences of this war were very unfortunate. The French monarch, repulsed from Rouen with loss, made a truce for six months; during which time he married Ingelburge, princess of Denmark, whose beauty could only be equalled by her virtue. The divorcing of this lady, whom he quitted in order to marry Agnes daughter of the duke of Merania, embroiled him with the court of Rome. The pope issued a sentence of excommunication against him; but it was taken off upon his promising to take back his former wife. John Sans-terre succeeded to the crown of England in 1199, to the prejudice of his nephew Arthur, to whom of right it belonged. The nephew, supported by Philip, took up arms against the uncle, but was defeated in Poictou, where he was taken prisoner, and afterwards murdered. The murderer, being summoned before the court of the peers of France, not having appeared, was declared guilty of his nephew's death, and condemned to lose his life in 1203. His lands, situated in France, were forfeited to the crown. Philip soon set about gathering the fruit of his vassal's crime. He seized upon Normandy, then carried his victorious arms into Maine, Anjou, Touraine, Poictou, and brought those provinces, as they anciently were, under the immediate authority of his crown. The English had no other part left them in France, but the province of Guienne. To crown his good fortune, John his enemy was embroiled with the court of Rome, which had lately excommunicated him. The ecclesiastical thunder was very favourable for Philip. Innocent II. put into his hands, and transferred to him, a perpetual right to the kingdom of England. This king of France, when formerly excommunicated by the pope, had declared his censures void and abusive; he thought very differently, however, when he found himself the executor of a bull investing him with the English crown. To give the greater force to the sentence pronounced by his holiness, he employed a whole year in building 1700 ships, and in preparing the finest army that was ever seen in France. Europe was in expectation of a decisive battle between the two kings, when the pope laughed at both, and artfully took to himself what he had bestowed upon Philip. A legate of the holy see persuaded John Sans terre to give his crown to the court of Rome, which received it with enthusiasm. Then Philip was expressly forbid by the pope to make any attempt upon England, now become a see of the Roman church, or against John who was under her protection. Meanwhile, the great preparations which Philip had made, alarmed all Europe; Germany, England, and the Low Countries, were united against him in the same manner as we have seen them united against Louis XIV. Ferrand, count of Flanders, joined the emperor Otho IV. He was Philip's vassal; which was the strongest reason for declaring against him. The French king was nowise disconcerted; his fortune and his courage dissipated all his enemies. His valour was particularly conspicuous at the battle of Bouvines, which was fought on the 27th of July 1214, and lasted from noon till night. Before the engagement, he knew well that some of his nobles followed him with reluctance. He assembled them together; and placing himself in the midst of them, he took a large golden cup, which he filled with wine, and into which he put several slices of bread. He ate one of them himself, and offering the cup to the rest, he said, "My companions, let those who would live and die with me follow my example." The cup was emptied in a moment, and those who were the least attached to him fought with all the bravery that could be expected from his warmest friends. It is also reported, that after showing the army the crown that was worn by sovereigns upon these occasions, he said, "If any one thought himself more worthy than he was to wear it, he had only to explain himself; that he should be content it were the prize of that man who should display the greatest valour in battle." The enemy had an army of 150,000 fighting men; that of Philip was not half so numerous; but it was composed of the flower of his nobility. The king run great hazard of his life; for he was thrown down under the horses feet, and wounded in the neck. It is said 30,000 Germans were killed; but the number is probably much exaggerated. The counts of Flanders and Boulogne were led to Paris with irons upon their feet and hands; a barbarous custom which prevailed at that time. The French king made no conquest on the side of Germany after this ever memorable action; but it gained him an additional power over his vassals. Philip, conqueror of Germany, and possessor of almost all the English dominions in France, was invited to the crown of England by the subjects of King John, who were grown weary of his tyranny. The king of France, upon this occasion, conducted himself like an able politician. He persuaded the English to ask his son Louis for their king; but as he wished at the same time to manage the pope, and not lose the crown of England, he chose to assist the prince his son, without appearing to act himself. Louis made a descent upon England, was crowned at London, and excommunicated at Rome in 1216; but that excommunication made no change upon John's situation, who died of grief. His death extinguished the resentment of the English, who having declared themselves for his son Henry III. forced Louis to leave England. Philip-Augustus died a little time after, at Mantes, the 14th of July 1223, aged 59, after a reign of 43 years. Of all the kings of the 3d race, he made the greatest accession to the crown-lands, and transmitted the greatest power to his successors. He reunited to his dominions Normandy, Anjou, Maine, Touraine, Poitou, &c. After having subdued John Sans-terre, he humbled the great lords, and by the overthrow of foreign and domestic enemies, took away the counterpoise which balanced his authority in the kingdom. He was more than a conqueror; he was a great king and an excellent politician; fond of splendour on public occasions, but frugal in private life; exact in the administration of justice; skilful in employing alternately flattery and threatenings, rewards and punishments; he was zealous in the defence of religion, and always disposed to defend the church; but he knew well how to procure from her succours for supplying the exigencies of the state. The lords of Coucy, Rhetel, Rosey, and several others, seized upon the property of the clergy. A great many of the prelates applied for protection to the king, who promised them his good offices with the depredators. But, notwithstanding his recommendations, the pillages continued. The bishops redoubled their complaints, and intreated Philip to march against their enemies. "With all my heart (said he); but in order to fight them, it is necessary to have troops, and troops cannot be raised without money." The clergy understood his meaning; they furnished subsidies, and the pillages ceased. The enterprises of Philip-Augustus were almost always successful; because he formed his projects with deliberation, and executed them without delay. He began by rendering the French happy, and in the end rendered them formidable; though he was more inclined to anger than to gentleness, to punish than to pardon, he was regretted by his subjects as a powerful genius and as the father of his country. It was in his reign that the marshal of France was seen, for the first time, at the head of the army. It was then, also, that families began to have fixed and hereditary surnames: the lords took them from the lands which they possessed; men of letters from the place of their birth; the converted Jews and rich merchants from that of their residence. Two very cruel evils, viz. leprosy and usury, were prevalent at that time; the one infected the body, the other proved the ruin of the fortunes of families. The number of lepers was so great, that the smallest villages were obliged to have an hospital for the cure of that distemper. It is remarkable, that when Philip was on the point of engaging Richard, the English, who were lying in ambush near the Loire, run away with his equipage, in which he caused to be carried all the deeds or writings respecting the rights of the crown; a custom which is used at this day by the grand seignior. Philip caused copies of his charters to be collected wherever they could be found; but after all his endeavours, some of them were never recovered. The surname of *Augustus* was given to Philip by his cotemporaries. Mezerai is mistaken, when he asserts that Paulus Emilius was the first who rendered the name of *conqueror* by that of Augustus; a learned critic has proved the contrary by undoubted authorities.

Philip of *Valois*, first king of France of the collateral branch of the Valois, was son to Charles count of Valois, brother of Philip *the Fair*. He mounted the throne in 1328, on the death of his cousin Charles the Fair, after having held for some time the regency of the kingdom. France was much divided in the beginning of his reign, by disputes about the succession to the crown. Edward III. king of England laid claim to it as grandson of Philip the Fair, by his mother; but Philip of Valois took possession of it as first prince of the blood. The people gave him, upon his accession to the throne, the title of *fortunate*; to which might have been added, for some time, those of *victorious* and *just*. He marched to the relief of his vassal the count of Flanders, whose subjects, on account of bad usage, had taken up arms against him. He engaged the rebels at Cassel, performed prodigies of valour, and gained a signal victory, the 24th of August 1328. Having made all quiet, he went home, after saying to the count of Flanders, "Be more prudent and more humane, and you will have fewer disloyal subjects." The victorious Philip devoted the time of peace to the internal regulations of his kingdom. The financiers were called to an account, and some of them condemned to death; among others Peter Remi, general of the finances, who left behind him near 20 millions. He afterwards enacted the law respecting freeholds, imposing a tax upon churches, and commoners who had acquired the lands of the nobility. Then, also, began to be introduced the form of *appel comme d'abus*, the principles of which are more ancient than the name. The year 1329 was distinguished by a solemn homage paid to Philip, by Edward king of England, for the duchy of Guienne, upon his knees, and with his head uncovered. The interior peace of the kingdom was disturbed by disputes about the distinction of the church and state. An assembly was summoned for hearing the two parties, in the presence of the king: and in this assembly Peter de Cugnieres, his majesty's advocate, defended the secular jurisdiction with great ability, as a man well-informed, and an enlightened philosopher. Bertrand bishop of Autun, and Roger archbishop of Sens, pled the cause of the clergy with less ingenuity and judgment. This did not, however, prevent the king from showing them favours, though the controversy itself laid the foundation of all the disputes which were afterwards agitated about the authority of the two powers; disputes which contributed not a little to confine the ecclesiastical jurisdiction within narrower limits. While Philip was employing himself in some useful regulations, he was unhappily interrupted by Edward III. declaring war against France. This prince immediately recovered those parts of Guienne of which Philip was in possession. The Flemish having again revolted from France in spite of oaths and treaties, joined the standard of Edward; and required that he would assume the title of *king of France*, in consequence of his pretensions to the crown; because, then, agreeably to the letter of their treaty, they only followed the king of France. From this period is dated the union of the flower-de luce and leopards in the arms of England. Edward, in order to justify the change of his arms, caused the following manifesto to be published in the verse of the times.

Rex sum regnorum, bina ratione, duorum:
Anglorum in regno sum rex ego jure paterno;
Matris jure quidem Francorum nuncupor idem:
Hinc est armorum variatio facta meorum.

In the way of a parody to these lines, Philip made the following reply:

Prædo regnorum qui diceris esse duorum,
Francorum regno privaberis, atque paterno,
Succedunt mares huic regno, non mulieres:
Hinc est armorum variatio stulta tuorum.

In the mean time Philip put himself in a posture of defence. His arms were at first attended with some success; but those advantages were far from compensating the loss of the battle of Ecluse, in which the French fleet, consisting of 120 large ships, and manned by 40,000 seamen, was beat by that of England in the year 1340. This defeat is to be attributed, in part, to the little attention which had been paid to the navy of France, notwithstanding her favourable situation, by being washed by two seas. She was obliged to make use of foreign ships, which obeyed but slowly, and even with some reluctance. This war, which had been alternately discontinued and renewed, began again with more heat than ever in 1345. The two armies having come to an engagement the 26th of August 1346, near Cressy, a village in the county of Ponthieu, the English there gained a signal victory. Edward had only 40,000 men, while Philip had nearly twice that number; but the army of the former was inured to war, and that of the latter was ill-disciplined and overcome with fatiguing marches. France lost from 25,000 to 30,000 men; of which numbers were John king of Bohemia (who, though blind, fought gallantly), and about 1500 gentlemen, the flower of the French nobility. The loss of Calais, and several other places, was the sad fruit of this defeat. Some time before Edward had challenged Philip of Valois to a single combat; which he refused, not on the score of cowardice, but from the idea that it was improper for a sovereign prince to accept a challenge from a king who was his vassal. At length, in 1347, a truce for six months was concluded between France and England, and afterwards prolonged at different times. Philip died a short time after, the 23d of August 1350, aged 57 years, and far from bearing on his monument the title of *Fortunate*. He had, however, reunited Dauphiny to France. Humbert, the last prince of that country, having lost all his children, and wearied with the wars which he had held out against Savoy, turned a Dominican, and gave his province to Philip, in 1349, on condition that the eldest son of the kings of France should bear the title of Dauphin. Philip likewise added to his domain Rousillon and a part of Cerdague, by lending some money to the king of Majorca, who gave him those provinces as a security; provinces which Charles VIII. afterwards restored without any reimbursement. It is surprising that in so unfortunate a reign he should have been able to purchase those provinces after having paid a great deal for Dauphiny; but the duty on salt, the rise on the other taxes, and especially the frauds committed in the coinage of money, are supposed to have enabled him to make those acquisitions. The fictitious and ideal value of the coin was not only raised, but a great deal of bad money was issued from the mint. The officers of the mint were sworn upon the gospels to keep the secret: but how could Philip flatter himself that so gross a fraud would not be discovered?

Philip II. son of Charles V. and of Isabella of Portugal, who was born at Valladolid on the 21st of May 1527, became king of Naples and Sicily by his father's abdication in 1554. He ascended the throne of Spain on the 17th of January 1556 by the same means. Charles had made a truce with the French, but his son broke it; and having formed an alliance with England, poured into Picardy an army of 40,000 men. The French were cut to pieces at the battle of St Quintin, which was fought on the 20th of August 1557. That town was taken by assault, and the day on which the breach was mounted Philip appeared armed cap-a-pee, in order to animate the soldiers. It was the first and last time that he was observed to wear this military dress. It is well known, indeed, that his terror was so great during the action that he made two vows; one, that he should never again be present in a battle; and the other, to build a magnificent monastery dedicated to St Lawrence, to whom he attributed the success of his arms, which he executed at Escurial, a village about seven leagues from Madrid. After the engagement, his general, the duke of Savoy, wanted to kiss his hand; but Philip prevented him, saying, "It is rather my duty to kiss your's, who have the merit of so glorious a victory; and immediately presented him with the colours taken during the action. The taking of Catelet, Ham, and Noyon, were the only advantages which were derived from a battle which might have proved the ruin of France. When Charles V. was informed of this victory, it is said he asked the person who brought him the intelligence, "if his son was at Paris?" and being answered in the negative, he went away without uttering a single word. The duke of Guise having had time to assemble an army, repaired the disgrace of his country by the taking of Calais and Thionville. While he was animating the French, Philip gained a pretty considerable battle against Marshal de Thermes near Gravelines. His army was, on this occasion, commanded by Count Egmont, whom he afterwards caused to be beheaded. The conqueror made no better use of the victory of Gravelines than he had done of that of St Quintin; but he reaped considerable advantage from the glorious peace of Cateau-Cambresis, the masterpiece of his politics. By that treaty, concluded the 13th of April 1559, he gained possession of the strong places of Thionville, Marienbourg, Montmedi, Hesdin, and the county of Charollois. This war, so terrible, and attended with so much cruelty, was terminated, like many others, by a marriage. Philip took for his third wife Elizabeth, daughter of Henry II. who had been promised to Don Carlos.

After these glorious achievements, Philip returned in triumph to Spain, without having drawn a sword. His first care, upon his arrival at Valladolid, was to demand of the grand inquisitor the spectacle of an *auto-da-fé*. This was immediately granted him; 40 wretches, some of whom were priests or monks, were strangled and burnt, and one of them was burnt alive. Don Carlos de Seza, one of these unfortunate victims, ventured to draw near to the king, and said to him, "How, Sir, can you suffer so many wretches to be committed to the flames? Can you be witness of such barbarity without weeping?" To this Philip coolly replied, "If my own son were suspected of heresy, I would myself give him up to the severity of the inquisition. Such is the horror which I feel when I think of you and your companions, that if an executioner were wanting, I would supply his place myself." On other occasions he conducted himself agreeably to the spirit which had dictated this answer. In a valley of Piedmont, bordering on the country of the Milanese, there were some heretics; and the governor of Milan had orders to put them all to death by the gibbet. The new opinions having found their way into some of the districts of Calabria, he gave orders that the innovators should be put to the sword, with the reservation of 60 of them, of whom 30 were afterwards strangled, and the rest committed to the flames.

This spirit of cruelty, and shameful abuse of his power, had the effect to weaken that power itself. The Flemish, no longer able to bear so hard a yoke, revolted. The revolution began with the fine and large provinces of the continent; but the maritime provinces only obtained their liberty. In 1579 they formed themselves into a republic, under the title of the United Provinces. Philip sent the duke of Alva to reduce them; but the cruelty of that general only served to exasperate the spirit of the rebels. Never did either party fight with more courage, or with more fury. The Spaniards, at the seige of Haerlem, having thrown into the town the head of a Dutch officer who had been killed in a skirmish, the inhabitants threw to them the heads of eleven Spaniards, with this inscription: "Ten heads for the payment of the tenth penny, and the eleventh for interest." Haerlem having surrendered at discretion, the conquerors caused all the magistrates, all the pastors, and above 1500 citizens, to be hanged.

The duke of Alva being at length recalled, the grand commander of the Requesnes was sent in his place, and after his death Don John of Austria; but neither of those generals could restore tranquillity in the Low Countries. To this son of Charles V. succeeded a grandson no less illustrious, namely, Alexander Farnese duke of Parma, the greatest man of his time; but he could neither prevent the independence of the United Provinces, nor the progress of that republic which arose under his own eye. It was then that Philip, always at his ease in Spain, instead of coming to reduce the rebels in Flanders, proscribed the prince of Orange, and set 25,000 crowns upon his head. William, superior to Philip, disdained to make use of that kind of vengeance, and trusted to his sword for his preservation.

In the mean time the king of Spain succeeded to the crown of Portugal, to which he had a right by his mother Isabella. This kingdom was subjected to him by the duke of Alva, in the space of three weeks, in the year 1580. Antony, prior of Crato, being proclaimed king by the populace of Lisbon, had the resolution to come to an engagement; but he was vanquished, pursued, and obliged to fly for his life.

A cowardly assassin, Balthazar Gerard, by a pistol-shot killed the prince of Orange, and thereby delivered Philip from his most implacable enemy. Philip was charged with this crime, it is believed without reason; though, when the news was communicated to him, he was imprudent enough to exclaim, "If this blow had been given two years ago, the Catholic religion and I would have gained a great deal by it."

This murder had not the effect to restore to Philip the Seven United Provinces. That republic, already powerful by sea, assisted England against him. Philip having resolved to distress Elizabeth, fitted out, in 1588, a fleet called the *Invincible*. It consisted of 150 large ships, on which were mounted 2650 pieces of cannon, 8000 seamen, 20,000 soldiers, and all the flower of the Spanish nobility. This fleet, commanded by the duke of Medina Sidonia, sailed from Lisbon when the season was too far advanced; and, being overtaken by a violent storm, a great part of it was dispersed. Twelve ships, driven upon the coast of England, were captured by the English fleet, which consisted of 100 ships; 50 were wrecked on the coasts of France, Scotland, Ireland, Holland, and Denmark. Such was the success of the Invincible. See ARMADA.

This enterprise, which cost Spain 40 millions of ducats, 20,000 men, and 100 ships, was productive only of disgrace. Philip supported this misfortune with a heroic resolution. When one of his courtiers told him, with an air of consternation, what had happened, he coolly replied, "I sent to fight the English, and not the winds. God's will be done." The day after Philip ordered the bishops to return thanks to God for having preserved some remains of his fleet; and he wrote thus to the pope: "Holy father, as long as I remain master of the fountain head, I shall not much regard the loss of a rivulet. I will thank the Supreme Disposer of empires, who has given me the power of easily repairing a disaster which my enemies must attribute solely to the elements which have fought for them."

At the same time that Philip attacked England, he was encouraging in France the Holy League; the object of which was to overturn the throne and divide the state. The leaguers conferred upon him the title of *Protector* of their association; which he eagerly accepted, from a persuasion that their exertions would soon conduct him, or one of his family, to the throne of France. He thought himself so sure of his prey, that when speaking of the principal cities in France, he used to say, "My fine city of Paris, my fine city of Orleans, in the same manner as he would have spoken of Madrid and Seville. What was the result of all those intrigues? Henry IV. embraced the Catholic religion, and by his abjuration of Protestantism made his rival lose France in a quarter of an hour.

Philip, at length, worn out by the debaucheries of his youth, and by the toils of government, drew near his last hour. A slow fever, the most painful gout, and a complication of other disorders, could not disengage him from business, or draw from him the least complaint.

plaint. "What!" said he to the physicians who hesitated about letting blood of him; "What! are you afraid of drawing a few drops of blood from the veins of a king who has made whole rivers of it flow from heretics?" At last, exhausted by a complication of distempers, which he bore with a heroic patience, and being eaten up of lice, he expired the 13th of September 1589, aged 72 years, after a reign of 43 years and eight months. During the last 50 days of his illness he showed a great sense of religion, and had his eyes almost always fixed towards heaven.

Watson's Philip II.

No character was ever drawn by different historians in more opposite colours than that of Philip; and yet, considering the length and activity of his reign, there is none which it should seem would be more easy to ascertain. From the facts recorded in history, we cannot doubt that he possessed, in an eminent degree, penetration, vigilance, and a capacity for government. His eyes were continually open upon every part of his extensive dominions. He entered into every branch of administration; watched over the conduct of his ministers with unwearied attention; and in his choice both of them and of his generals, discovered a considerable share of sagacity. He had at all times a composed and settled countenance, and never appeared to be either elated or depressed. His temper was the most imperious, and his looks and demeanor were haughty and severe; yet among his Spanish subjects he was of easy access; listened patiently to their representations and complaints; and where his ambition and bigotry did not interfere, was generally willing to redress their grievances. When we have said thus much in his praise, we have said all that truth requires or truth permits. It is indeed imposible to suppose that he was insincere in his zeal for religion. But as his religion was of the most corrupt kind, it served to increase the natural depravity of his disposition; and not only allowed, but even prompted, him to commit the most odious and shocking crimes. Although a prince in the bigotted age of Philip might be persuaded that the interest of religion would be advanced by falsehood and persecution; yet it might be expected, that, in a virtuous prince, the sentiments of honour and humanity would on some occasions triumph over the dictates of superstition: but of this triumph there occurs not a single instance in the reign of Philip; who without hesitation violated his most sacred obligations as often as religion afforded him a pretence, and under that pretence exercised for many years the most unrelenting cruelty without reluctance or remorse. His ambition, which was exorbitant; his resentment, which was implacable; his arbitrary temper, which would submit to no controul—concurred with his bigotted zeal for the Catholic religion, and carried the sanguinary spirit, which that religion was calculated to inspire, to a greater height in Philip than it ever attained in any other prince of that or of any former or succeeding age.

Though of a small size, he had an agreeable person. His countenance was grave, his air tranquil, and one could not discover from his looks either joy in prosperity or chagrin in adversity. The wars against Holland, France, and England, cost Philip 564 millions of ducats; but America furnished him with more than the half of that sum. His revenues, after the junction of Portugal, are said to have amounted to 25 millions of ducats, of which he only laid out 100,000 for the support of his own household. Philip was very jealous of outward respect; he was unwilling that any should speak to him but upon their knees. The duke of Alva having one day entered this prince's cabinet without being introduced, he received the following harsh salutation, accompanied with a stormy countenance: "An impudence like this of yours would deserve the hatchet." If he thought only how to make himself be feared, he succeeded in doing so; for few princes have been more dreaded, more abhorred, or have caused more blood to flow, than Philip II. of Spain. He had successively, if not all at once, war to maintain against Turkey, France, England, Holland, and almost all the Protestants of the empire, without having a single ally, not even the branch of his own house in Germany. Notwithstanding so many millions employed against the enemies of Spain, Philip found in his economy and his resources wherewith to build 30 citadels, 64 fortified places, 9 sea ports, 25 arsenals, and as many palaces, without including the Escurial. His debts amounted to 140 millions of ducats, of which after having paid seven millions of interest, the greatest part was due to the Genoese. Moreover, he had sold or alienated a capital stock of 100 millions of ducats in Italy. He made a law, fixing the majority of the kings of Spain at 14 years of age. He affected to be more than commonly devout; he ate often at the refectory with the monks; he never entered their churches without kissing all the relics; he caused knead his bread with the water of a fountain which was thought to possess a miraculous virtue; he boasted of never having danced, and of never wearing breeches after the Grecian fashion. Grave and solemn in all his actions, he drove from his presence a woman who had smiled while he was blowing his nose. One great event of his domestic life is the death of his son Don Carlos. The manner of this prince's death is not certainly known. His body, which lies in the monument of the Escurial, is there separated from his head; but it is pretended that the head is separated only because the leaden coffin which contains the body is too small. The particulars of his crime are as little known as the manner in which it was committed. There is no evidence, nor is there any probability, that Philip would have caused him to be condemned by the inquisition. All that we know of the matter is, that in 1568 his father, having discovered that he had some correspondence with the Hollanders his enemies, arrested him himself in his own room. He wrote at the same time to Pope Pius V. in order to give him an account of his son's imprisonment; and in his letter to this pontiff, the 20th of January 1568, he says, "that from his earliest years the strength of a wicked nature has stifled in Don Carlos every paternal instruction." It was Philip II. who caused to be printed at Anvers, between 1569 and 1572, in 8 vols folio, the fine Polyglot Bible, which bears his name; and it was he who subjected the islands afterwards called the *Philippines*. He married successively, 1st, Mary daughter of John III. king of Portugal; 2dly, Mary daughter of Henry VIII. and queen of England; 3dly, Elizabeth of France, daughter of Henry II.; 4thly, Anne daughter of the emperor Maximilian II. Don Carlos was the son of his first wife, and Philip III. of the last.

PHILIPPI, in *Ancient Geography*, a town of Macedonia, in the territory of the Edones, on the confines of Thrace (Pliny, Ptolemy), situated on the side of a steep eminence; anciently called *Datum* and *Drenides* (Appian), though Strabo seems to distinguish them. This town was famous on several accounts; not only as taking its name from the celebrated Philip of Macedon, father to Alexander the Great, who considered it as a fit place for carrying on the war against the Thracians, but also on account of two battles fought in its neighbourhood between Augustus and the republican party. In the first of these battles, Brutus and Cassius had the command of the republican army; while Octavianus, afterwards Augustus, and Mark Antony, had the command of their adversaries. The army of Brutus and Cassius, consisted of 19 legions and 20,000 horse; the imperial forces of an equal number of legions, but more complete, and 13,000 horse; so that the numbers on both sides were pretty equal. The troops of Brutus were very richly dressed, most of them having their armour adorned with gold and silver; for, Brutus, though very frugal in other respects, was thus extravagant with respect to his men, thinking that the riches that they had about them would make them exert themselves the more, to prevent these from falling into the enemy's hands. Both the republican generals appear to have been inferior in skill to Mark Antony; for as to Octavianus, he is allowed never to have conquered but by the valour of others. A little before the first engagement, Octavianus, who had been indisposed, was carried out of the camp, at the persuasion of Artorius his physician, who had dreamed that he saw a vision directing him to be removed. Brutus's men, who opposed the wing commanded by Octavianus, charged without orders, which caused great confusion. However, they were successful; for part of them, taking a compass about, fell upon the enemy's rear: after which they took and plundered the camp, making a great slaughter of such as were in it, and among the rest putting 2000 Lacedæmonians to the sword who were newly come to the assistance of Octavianus. The emperor himself was sought for, but in vain, having been conveyed away for the reason above mentioned; and as the soldiers pierced the litter in which he was usually carried, it was thence reported that he had been killed. This threw that whole part of the army into such consternation, that when Brutus attacked them in front, they were most completely routed; three whole legions being cut in pieces, and a prodigious slaughter made among the fugitives. But by the imprudence of the general in pursuing too far, the wing of the republican army commanded by Cassius was left naked and separated from the rest of the army; on which they were attacked at once in front and in flank, and thus they were defeated and their camp taken, while Brutus imagined that he had gained a complete victory. Cassius himself retired to an eminence at a small distance from Philippi; whence he sent one of his greatest intimates to procure intelligence concerning the fate of Brutus. That general was on his way, and already in view, when the messenger set out. He soon met his friends; but they surrounding him to inquire the news, Cassius, who beheld what passed, imagined that he was taken prisoner by the enemy, retired to his tent, and in despair caused one of his freedmen cut off his head. Thus far at least is certain, that he went into the tent with that freedman, and that his head was found separated from his body when Brutus entered. However, the freedman was never afterwards seen.

The second engagement was pretty similar to the first. Brutus again opposed Octavianus, and met with the same success; but in the mean time Antony, to whom he ought undoubtedly to have opposed himself, having to do only with the lieutenants of Cassius, gained a complete victory over them. What was worst, the fugitives, instead of leaving the field of battle altogether, fled for protection to Brutus's army; where crowding in among the ranks, they carried despair and confusion wherever they went, so that a total defeat ensued, and the republican army was almost entirely cut in pieces. After the battle, Brutus put an end to his own life, as is related more fully under the article Rome.

The city of Philippi is likewise remarkable on account of an epistle written by St Paul to the church in that place. It was a Roman colony (Luke, Pliny, Coin, Inscription). It is also remarkable for being the birth-place of Adrastus, the Peripatetic philosopher, and disciple of Aristotle.—The town is still in being, and is an archbishop's see; but greatly decayed and badly peopled. However, there is an old amphitheatre, and several other monuments of its ancient grandeur. E. Long. 44. 55. N. Lat. 41. 0.

PHILIPPICS, Φιλιππικοι λογοι, in literature, is a name which is given to the orations of Demosthenes against Philip king of Macedon. The Philippics are reckoned the master-pieces of that great orator: Longinus quotes many instances of the sublime from them; and points out a thousand latent beauties. Indeed that pathetic in which Demosthenes excelled, the frequent interrogations and apostrophes wherewith he attacked the indolence of the Athenians, where could they be better employed? Whatever delicacy there be in the oration against Leptines, the Philippics have the advantage over it, were it only on account of the subject, which gives Demosthenes so fair a field to display his chief talent, we mean, with Longinus, that of moving and astonishing.

Dionysius Halicarnasseus ranks the oration on the Halonese among the Philippics, and places it the eighth in order: but though his authority be great, yet that force and majesty wherein Cicero characterizes the Philippics of Demosthenes, seem to exclude the oration on the Halonese out of the number; and authorize the almost universal opinion of the learned, who reject it as spurious. Libanus, Photius, and others, but above all the languidness of the style, and the lowness of the expressions, which reign throughout the whole, father it on Hegesippus.

Philippics is likewise applied to the fourteen orations of Cicero against Mark Antony. Cicero himself gave them this title in his epistle to Brutus; and posterity have found it so just, that it has been continued to our times. Juvenal, Sat. x. calls the second the *divine Philippic*, and witnesses it to be of great fame, *conspicuæ divina Philippica famæ*. That orator's intitling his last and most valued orations after the Philippics of Demosthenes shews the high opinion he had of them. Cicero's Philippics cost him his life; Mark Antony having been so irritated with them, that when he arrived at the triumvirate, he procured Cicero's murder, Philippics, Philippine Islands.

der, cut off his head, and stuck it up in the very place whence the orator had delivered the Philippics.

Beatson's Mil. Mem.

PHILIPPINE ISLANDS, are certain islands of Asia, which lie between 114 and 126 degrees of east longitude, and between 6 and 20 degrees of north latitude; about 300 miles south-east of China. They are said to be about 1200 in number, of which there are 400 very considerable. They form a principal division of that immense Indian Archipelago, which consists of so many thousand islands, some of which are the largest, and many of them the richest, in the world. The Philippines form the northernmost cluster of these islands, and were discovered in the year 1521 by the famous navigator Ferdinand Magellan, a Portuguese gentleman, who had served his native country both in the wars of Africa and in the East Indies; particularly under Albuquerque, the famous Portuguese general, who reduced Goa and Malacca to the obedience of that crown. Magellan having had a considerable share in those actions, and finding himself neglected by the government of Portugal, and even denied, as it is said, the small advance of a ducat a month on his pay, left the court of Portugal in disgust, and offered his services to Charles V. then emperor of Germany and king of Spain, whom he convinced of the probability of discovering a way to the Spice islands, in the East Indies, by the west: whereupon the command of five small ships being given him, he set sail from Seville, on the 10th of August 1519, and standing over to the coast of South America, proceeded southward to 52°, where he fortunately hit upon a strait, since called the *Strait of MAGELLAN*, which carried him into the Pacific ocean or South sea; and then steering northward, repassed the equator: after which, he stretched away to the west, across that vast ocean, till he arrived at Guam, one of the Ladrones, on the 10th of March 1521; and soon after sailed to the westward, and discovered the Philippines, which he did on St Lazarus's day; and, in honour of that saint, he called them the *Archipelago of St Lazarus*. He took possession of them in the name of the king of Spain, but happened to be killed in a skirmish he had with the natives of one of them. His people, however, arrived afterwards at the Moluccas, or Clove islands, where they left a colony, and returned to Spain by the way of the Cape of Good Hope; being the first persons that ever sailed round the globe.—But there was no attempt made by the Spaniards to subdue or plant the Philippine islands until the year 1564, in the reign of Philip II. son of Charles V. when Don Louis de Velasco, viceroy of Mexico, sent Michael Lopez Delagaspes thither with a fleet, and a force sufficient to make a conquest of these islands, which he named the *Philippines*, in honour of Philip II. then upon the throne of Spain: and they have remained under the dominion of that crown till taken by Sir William Draper. The Philippines are scarce inferior to any other islands of Asia in all the natural productions of that happy climate; and they are by far the best situated for an extensive and advantageous commerce. By their position, they form the centre of intercourse with China, Japan, and the Spice islands; and whilst they are under the dominion of Spain, they connect the Asiatic and American commerce, and become a general magazine for the rich manufactures of the one and for the treasures of the other. Besides, they are well situated for a supply of European goods, both from the side of Acapulco and by the way of the Cape of Good Hope. In fact, they formerly enjoyed a traffic in some degree proportioned to the peculiar felicity of their situation; but the Spanish dominion is too vast and unconnected to be improved to the best advantage.—The spirit of commerce is not powerful in that people. The trade of the Philippines is thought to have declined; its great branch is now reduced to two ships, which annually pass between these islands and Acapulco in America, and to a single port of Manilla in the island of Luconia.

Philippine Islands.

Indeed the Spaniards appear by no means to be actuated by the spirit of industry; for, so far from improving the fine situation of these islands to the utmost, it happens, on the contrary, that the trade is hurtful to the mother-country; for (to confine ourselves to Manilla, with which they have most to do), instead of taking Spanish manufactures, they trade with the Chinese for spices, silks, stockings, Indian stuffs, callicoes, chintz, and many other articles; and with the Japanese for cabinets, and all sorts of lacquered ware; for all which they pay in gold or silver. All these commodities, together with what the islands produce, and great quantities of wrought plate by the Chinese artisans, are collected at Manilla, and transported annually in two ships to Acapulco in Mexico. Each of these ships is esteemed worth 600,000l. sterling; and in the war which began in 1739, and which was not distinguished by such a series of wonderful successes as that which ended in 1763, the taking of one of the galleons which carry on the trade between Manilla and America, was considered as one of the most brilliant advantages which we gained. This trade is not laid open to all the inhabitants of Manilla, but is confined by very particular regulations, somewhat analogous to those by which the trade of the register ships from Cadiz to the West Indies is restrained. The ships employed are all king's ships, commissioned and paid by him; and the tonnage is divided into a certain number of bales, all of the same size. These are divided among the convents at Manilla, but before the suppression of the Jesuits principally among them, as a donation to support their missions, for the propagation of the Roman Catholic faith. Most of the religious are concerned in this trade, and sell to the merchants at a great price what room in the ship they are not to occupy. This trade is by a royal edict limited to a certain value, but it always exceeds it, each ship being generally worth 3,000,000 of dollars. The returns made from America are in silver, cochineal, sweetmeats, together with some European millinery ware for the women, and some strong Spanish wine. It is obvious, that the greatest part of the treasure remitted does not remain at Manilla, but is dispersed over India for goods. Many strong remonstrances against this Indian trade to Mexico have been made to the court of Spain, wherein they urge, that the silk manufactories of Valentia and other parts of Spain, the linens from Cadiz, and their other manufactories, are hurt in their sale in Mexico and Peru, by the Chinese being able to afford them goods of the same sort cheaper than they are able; that were this trade laid open, the whole treasure of the New World would centre in Spain, or with European merchants; but now it enriches only some religious orders and a few private persons. Wise as these arguments are, the Jesuits and priests, versant in intrigue, and the most selfish set of men on earth, had interest enough at court to stop the effect.

At Cavite in this bay are a fort, a town, and a fine dock-yard, where these large galleons are built and repaired, and where they load and unload, together with all the other large ships that trade to this bay.

The principal of the Philippine islands are Luconia or Manilla, Tandago or Samar, Masbate, Mindora, Luban, Paragoa, Panay, Leyte, Bohel, Sibu, Sogbu, Negros, St John, Xolo, and Mindanao. In most of these, the Spanish power prevails, and all are under the governor of Luconia; but there are some in which that nation has little authority, or even influence, such as Mindanao.

The inhabitants of these islands consist of Chinese, Ethiopians, Malays, Spaniards, Portuguese, Pintados or Painted People, and Mestees, a mixture of all these. Their persons and habits resemble those of the several nations whence they derive their original; only, it is observable, that the features of the blacks of these islands are as agreeable as those of the white people. There is not a soil in the world that produces greater plenty of all things for life; as appears by the multitude of inhabitants to be found in the woods and mountains, who subsist almost entirely by the fruits of the earth, and the venison they take. Nor can any country appear more beautiful; for there is a perpetual verdure, and buds, blossoms, and fruit, are found upon the trees all the year round, as well on the mountains as in the cultivated gardens. Vast quantities of gold are washed down from the hills by the rains, and found mixed with the sand of their rivers. There are also mines of other metals, and excellent loadstones, found here; and such numbers of wild buffaloes, that a good huntsman on horseback, armed with a spear, may kill 10 or 20 in a day. The Spaniards take them for their hides, which they sell to the Chinese; and their carcases serve the mountaineers for food. Their woods also abound with deer, wild hogs, and goats. Of the last, there is such plenty in one of these islands, that the Spaniards gave it the name of *Cabras*. Horses and cows have been likewise imported into these islands, from New Spain, China, and Japan, which have multiplied considerably; but the sheep that were brought over came to nothing. The trees produce a great variety of gums; one kind, which is the commonest, by the Spaniards called *breu*, is used instead of pitch; of the others some are medicinal, others odoriferous.

In these islands are monkeys and baboons of such a size, as to defend themselves if attacked by men. When they can find no fruit in the mountains, they go down to the sea to catch crabs and oysters; and that the oysters may not close and catch their paws, they first put in a stone to prevent their shutting close: they take crabs by putting their tail in the holes where they lie, and when the crab lays hold of it, they draw him out. There are also great numbers of civet-cats in some of the islands. The bird called *tavan*, is a black sea-fowl, something less than a hen, and has a long neck; it lays its eggs on the sand by the sea side, 40 or 50 in a trench, and then covers them, and they are hatched by the heat of the sun. They have likewise the bird *saligan*, which builds her nest on the sides of rocks. This is a species of swallow the nests of which are so much esteemed in the east, being a kind of jelly that dissolves in warm water.

The Spaniards have introduced several of the American fruits, which thrive here as well as in America; the cocoa or chocolate-nut particularly, which increases so that they have no occasion now to import it from Mexico. Here is also the *FOUNTAIN-Tree*, from which the natives draw water; and there is likewise a kind of cane, by the Spaniards called *vaxuco*, which, if cut, yields fair water enough for a draught, of which there is plenty in the mountains, where water is most wanted.

These islands being hot and moist, produce abundance of venomous creatures, as the soil does poisonous herbs and flowers, which do not kill those who touch or taste them, but so infect the air, that many people die in the time of their blossoming.

The orange, lemon, and several other trees, bear twice a-year. A sprig, when planted, becomes a tree and bears fruit in a year's time; so that without any hyperbole it may be affirmed, that a more luxuriant verdant soil can scarcely be conceived. The woods are filled with old, large, and lofty trees, and such as yield more sustenance to man than is to be found in almost any other part of the world. These islands, however, besides their other inconveniences, of which they have many, are very subject to earthquakes, which often prove very fatal. See MANILLA.

PHILIPPINES, a religious society of young women at Rome, so called from their taking St Philip de Neri for their protector. The society consists of 100 poor girls, who are brought up till they are of age to be married, or become nuns, under the direction of some religious women, who teach them to read, write, and work, and instruct them in the duties of Christianity. They wear a white veil, and a black cross on their breasts. See MACEDONIA.

PHILIPPISTS, a sect or party among the Lutherans; the followers of Philip Melancthon. He had strenuously opposed the Ubiquists, who arose in his time; and the dispute growing still hotter after his death; the university of Wirtemberg, who espoused Melancthon's opinion, were called by the Flacians, who attacked it, *Philippists*.

PHILIPS, FABIAN, was author of several books relating to ancient customs and privileges in England. He was born at Prestbury in Gloucestershire, September 28. 1601. When very young, he spent some time in one of the Inns of Chancery; and went from thence to the Middle-Temple, where he became learned in the law. In the civil wars, he was a bold assertor of the king's prerogative; and was so strongly attached to Charles I. that, two days before that monarch was beheaded, he wrote a protestation against the intended murder, and caused it to be printed, and affixed to posts in all public places. He likewise published, in 1649, 4to, a pamphlet entitled, "*Veritas Inconcussa;* or King Charles I. no Man of Blood, but a Martyr for his People:" which was reprinted in 1660, 8vo. In 1663, when the courts of justice at Westminster, especially the chancery, were voted down by Oliver's parliament, he published, "Considerations against the dissolving and taking them away:" for which he received the thanks of parliament. He was for some time filazer for London,

don, Middlesex, Cambridgeshire, and Huntingdonshire; and spent much money in searching records, and writing in favour of the royal prerogative. The only advantage he received for this attachment to the royal cause was, the place of one of the commissioners for regulating the law, worth 200l. per annum, which only lasted two years. After the restoration of Charles II. when the bill for taking away the tenures was depending in parliament, he wrote and published a book to show the necessity of preserving them, entitled, "*Tenenda non tollenda;* or, the Necessity of preserving Tenures *in capite*, and by Knight's service, which, according to their first institution, were, and are yet, a great part of the *salus populi*, &c. 1660," 4to. In 1663 he published, "The Antiquity, Legality, Reason, Duty, and Necessity of Pre-emption and Pourveyance for the King," 4to; and afterwards many other pieces upon subjects of a similar kind. He assisted Dr Bates in his "*Elenchus Motuum;* especially in searching the records and offices for that work. He died, November 17th, 1690, in his 89th year. He was a man well acquainted with records and antiquities; but his manner of writing is neither close nor well digested. He published a political pamphlet in 1681, entitled, "*Ursa Major et Minor;* showing that there is no such Fear, as is fictitiously pretended, of Popery and arbitrary Power."

Philips, *Ambrose*, an English poet, was descended from a very ancient and considerable family of that name in Leicestershire. He received his education at St John's college, Cambridge; during his stay at which university, he wrote his pastorals, which acquired him at that time so high a reputation. His next performance was, The Life of Archbishop Williams, written, according to Mr Cibber, to make known his political principles, which in the course of it he had a free opportunity of doing, as the archbishop, who is the hero of his work, was a strong opponent to the high-church measures.

When he quitted the university, and came to London, he became a constant attendant at, and one of the wits of, Button's coffee-house, where he obtained the friendship and intimacy of many of the celebrated geniuses of that age, more particularly of Sir Richard Steele, who, in the first volume of his Tatler, has inserted a little poem of Mr Philips's, which he calls a Winter Piece, dated from Copenhagen, and addressed to the earl of Dorset, on which he bestows the highest encomiums; and, indeed, so much justice is there in these his commendations, that even Mr Pope himself, who had a fixed aversion to the author, while he affected to despise his other works, used always to except this from the number.

The first dislike Mr Pope conceived against Mr Philips, proceeded from that jealousy of fame which was so conspicuous in the character of that great poet; for Sir Richard Steele had taken so strong a liking to the pastorals of the latter, as to have formed a design for a critical comparison of them with those of Pope, in the conclusion of which the preference was to have been given to Philips. This design, however, coming to Mr Pope's knowledge, that gentleman, who could not bear a rival near the throne, determined to ward off this stroke by a stratagem of the most artful kind; which was no other than taking the same task on himself; and, in a paper in the Guardian, by drawing the like comparison, and giving a like preference, but on principles of criticism apparently fallacious, to point out the absurdity of such a judgment. However, notwithstanding the ridicule that was drawn on him in consequence of his standing as it were in competition with so powerful an antagonist, it is allowed, that there are, in some parts of Philips's pastorals, certain strokes of nature, and a degree of simplicity, that are much better suited to the purposes of pastoral, than the more correctly turned periods of Mr Pope's versification. Mr Philips and Mr Pope being of different political principles, was another cause of enmity between them; which arose at length to so great a height, that the former, finding his antagonist too hard for him at the weapon of wit, had even determined on making use of a rougher kind of argument; for which purpose he even went so far as to hang up a rod at Button's for the chastisement of his adversary whenever he should come thither; which, however, Mr Pope declining to do, avoided the *argumentum baculinum*, in which he would, no doubt, have found himself on the weakest side of the question. Our author also wrote several dramatical pieces; The Briton, Distressed Mother, and Humphrey Duke of Gloucester; all of which met with success, and one of them is at this time a standard of entertainment at the theatres, being generally repeated several times in every season. Mr Philips's circumstances were in general, through his life, not only easy, but rather affluent, in consequence of his being connected, by his political principles, with persons of great rank and consequence. He was concerned with Dr Hugh Boulter, afterwards archbishop of Armagh, the right honourable Richard West, Esq. lord chancellor of Ireland, the reverend Mr Gilbert Burnet, and the reverend Mr Henry Stevens, in writing a series of papers called the *Free Thinker*, which were all published together by Mr Philips, in three volumes in 12mo.

In the latter part of Queen Anne's reign, he was secretary to the Hanover club, who were a set of noblemen and gentlemen who had formed an association in honour of that succession, and for the support of its interests, and who used particularly to distinguish in their toasts such of the fair sex as were most zealously attached to the illustrious House of Brunswic. Mr Philip's station in this club, together with the zeal shown in his writings, recommended him to the notice and favour of the new government. He was, soon after the accession of King George I. put into the commission of the peace, and appointed one of the commissioners of the lottery, And, on his friend Dr Boulter's being made primate of Ireland, he accompanied that prelate across St George's Channel, where he got considerable preferments bestowed on him, and was elected a member of the House of Commons there, as representative for the county of Armagh. At length, having purchased an annuity for life of 400l. per annum, he came over to England some time in the year 1748; but having a very bad state of health, and being moreover of an advanced age, he died soon after, at his lodgings near Vauxhall, in Surrey.

"Of his personal character (says Dr Johnson) all I have heard is, that he was eminent for bravery, and skill in the sword, and that in conversation he was solemn and pompous." He is somewhere called *Quaker Philips*, but, however, appears to have been a man of integrity;

grity; for the late Paul Whitehead relates, that when Mr Addison was secretary of state, Philips applied to him for some preferment, but was coolly answered, "that it was thought that he was already provided for, by being made a justice for Westminster. To this observation our author, with some indignation, replied, "Though poetry was a trade he could not live by, yet he scorned to owe subsistence to another which he ought not to live by."

The following anecdote is told of our author by Dr Johnson: "At a coffee-house, he (Philips) was discoursing upon pictures, and pitying the painters, who, in their historical pieces, always draw the same sort of *sky*." "They should travel (said he), and then they would see that there is a different *sky* in every country, in England, France, Italy, and so forth." "Your remark is just (said a grave gentleman who sat by), I have been a traveller, and can testify what you observe is true; but the greatest variety of *skies* that I found was in Poland." "In Poland, Sir? (says Philips)." "Yes, in Poland; for there is Sobie*sky*, and Sabrun*sky*, and Jablon*sky*, and Podebra*sky*, and many more *skies*."

Philips, *Catharine*, a very ingenious lady, the daughter of Mr John Fowler merchant, was born at London in January 1631, and educated at a school at Hackney. She married James Philips of the priory of Cardigan, Esq. and went with the viscountess of Dungannon into Ireland, where she translated Corneille's tragedy of Pompey into English, which was several times acted there with great applause.

She translated also the four first acts of Horace, another tragedy of Corneille, the fifth being done by Sir John Denham. This excellent and amiable lady, for such it seems she was, died of the small pox in London the 22d of June 1664, much and justly regretted; "having not left (says Langbaine) any of her sex her equal in poetry.—She not only equalled (adds he) all that is reported of the poetesses of antiquity, the Lesbian Sappho and the Roman Sulpitia, but justly found her admirers among the greatest poets of our age." Cowley wrote an ode upon her death. Dr Jeremy Taylor had addressed to her his "Measures and Offices of Friendship:" the second edition of which was printed in 1657, 12mo. She assumed the name of *Orinda*. In 1667, were printed, in folio, "Poems by the most deservedly admired Mrs Catharine Philips, the matchless Orinda. To which is added, Monsieur Corneille's Pompey and Horace, tragedies. With several other translations from the French;" and her picture before them, engraven by Faithorne. There was likewise another edition in 1678, folio; in the preface of which we are told, that "she wrote her familiar letters with great facility, in a very fair hand, and perfect orthography; and if they were collected with those excellent discourses she wrote on several subjects, they would make a volume much larger than that of her poems." In 1705, a small volume of her letters to Sir Charles Cottrel was printed, under the title of "Letters from Orinda to Poliarchus." The editor of these letters tells us, that "they were the effect of an happy intimacy between herself and the late famous Poliarchus, and are an admirable pattern for the pleasing correspondence of a virtuous friendship. They will sufficiently instruct us, how an intercourse of writing between persons of different sexes ought to be managed with delight and innocence; and teach the world not to load such a commerce with censure and detraction, when it is removed at such a distance from even the appearance of guilt."

Philips, *John*, an eminent English poet, was born in 1676. He was educated at Winchester and Oxford, where he became acquainted with Milton, whom he studied with great application, and traced in all his successful translations from the ancients. The first poem which distinguished our author, was his Splendid Shilling, which is in the Tatler styled the "finest burlesque poem in the English language." His next was entitled Blenheim, which he wrote at the request of the earl of Oxford, and Mr Henry St John, afterwards Lord Bolingbroke, on the victory obtained there by the duke of Marlborough in 1704. It was published in 1705; and the year after he finished another poem upon cyder, the first book of which had been written at Oxford. It is on the model of Virgil's Georgics, and is a very excellent piece. We have no more of Mr Philips but a Latin ode to Henry St John, Esq. which is esteemed a masterpiece. He was contriving greater things; but illness coming on, he was obliged to drop every thing but the care of his health. This care, however, did not save him: for, after lingering a long time, he died at Hereford, Feb. 15. 1708, of a consumption and asthma, before he had reached his 33d year. He was interred in the cathedral of that city, with an inscription over his grave; and had a monument erected to his memory in Westminster-abbey by Sir Simon Harcourt, afterwards lord-chancellor, with an epitaph upon it written by Dr Atterbury, though commonly ascribed to Dr Freind. He was one of those few poets whose muse and manners were equally excellent and amiable; and both were so in a very eminent degree.

Dr Johnson observes, that "Philips has been always praised, without contradiction, as a man modest, blameless, and pious; who bore a narrow fortune without discontent, and tedious and painful maladies without impatience; beloved by those that knew him, but not ambitious to be known. He was probably not formed for a wide circle. His conversation is commended for its innocent gaiety, which seems to have flowed only among his intimates; for I have been told, that he was in company silent and barren, and employed only upon the pleasures of his pipe. His addiction to tobacco is mentioned by one of his biographers, who remarks, that in all his writings except Blenheim he has found an opportunity of celebrating the fragrant fume. In common life, he was probably one of those who please by not offending, and whose person was loved, because his writings were admired. He died honoured and lamented before any part of his reputation had withered, and before his patron St John had disgraced him. His works are few. The Splendid Shilling has the uncommon merit of an original design, unless it may be thought precluded by the ancient *Centos*. To degrade the sounding works and stately construction of Milton, by an aplication to the lowest and most trivial things, gratifies the mind with a momentary triumph over that grandeur which hitherto held its captives in admiration; the words and things are presented with a new appearance, and novelty is always grateful where it gives no pain. But the merit of such performances begins and ends with the first author. He that should again adapt Milton's phrase to the gross incidents of common life, and even adapt it with more art, which would not be difficult, must yet expect but a small part of the praise which Philips has obtained: he can only hope to be considered as the repeater of a jest.

"There is a Latin ode written to his patron St John, in return for a present of wine and tobacco, which cannot be passed without notice. It is gay and elegant, and exhibits several artful accommodations of classic expressions to new purposes. It seems better turned than the odes of Hannes. To the poem on cyder, written in imitation of the Georgics, may be given this peculiar praise, that it is grounded in truth; that the precepts which it contains are exact and just; and that it is therefore at once a book of entertainment and of science. This I was told by Miller, the great gardener and botanist, whose expression was, that 'there were many books written on the same subject in prose, which do not contain so much truth as that poem.' In the disposition of his matter, so as to intersperse precept, relating to the culture of trees, with sentiments more generally pleasing, and in easy and graceful transitions from one subject to another, he has very diligently imitated his master; but he unhappily pleased himself with blank verse, and supposed that the numbers of Milton, which impress the mind with veneration, combined as they are with subjects of inconceivable grandeur, could be sustained by images which at most can rise only to elegance. Contending angels may shake the regions of heaven in blank verse; but the flow of equal measures and the embellishment of rhime, must recommend to our attention the art of engrafting, and decide the merit of the redstreak and pearmain. What study could confer, Philips had obtained; but natural deficiency cannot be supplied. He seems not born to greatness and elevation. He is never lofty, nor does he often surprise with unexpected excellence: but perhaps to his last poem may be applied what Tully said of the work of Lucretius, that 'it is written with much art, though with few blazes of genius.'"

It deserves to be remarked, that there were two poets of both the names of our author, and who flourished in his time. One of them was Milton's nephew, and wrote several things, particularly some memoirs of his uncle, and part of Virgil Travestied. The other was the author of two political farces, which were both printed in 1716; 1. The Earl of Marr married, with the Humours of Jocky the Highlander. 2. The pretender's Flight; or a Mock Coronation, with the Humours of the facetious Harry St John.

PHILIPSBURG, is an imperial town of Germany, in the circle of the Upper Rhine. It is very strong, and looked upon as one of the bulwarks of the empire. It is seated in a morass, and fortified with seven bastions and several advanced works. The town belongs to the bishop of Spire, but all the works and the fortifications to the empire. It has been several times taken and retaken, particularly by the French in 1734, when the duke of Berwick was killed at the siege; but it was rendered back the year following, in consequence of the treaty of Vienna. It is seated on the river Rhine, over which there is a bridge, seven miles south of Spire, 22 south-east of Worms, and 40 north-east of Strasburg. E. Long. 8. 33. N. Lat. 49. 12.

PHILISTÆA, in *Ancient Geography*, the country of the Philistines (Bible); which lay along the Mediterranean, from Joppa to the boundary of Egypt, and extending to inland places not far from the coast. *Palæstini*, the people; *Palæstina*, the country (Josephus): Afterwards applied to the whole of the Holy Land and its inhabitants. *Philistæi*, the people (Septuagint): *Philistini* (Vulgate); the *Caphtorim* and *Philistim*, originally from Egypt, and descendants of Cham (Moses). Expelled and destroyed the Hivites the ancient inhabitants, and occupied their country; that is, the region which retained the name of *Philistim*, in which that of *Caphtorim* was swallowed up.

PHILISTINES, were the ancient inhabitants of Palestine, well known in sacred history. These people are sometimes called in Scripture *Cherethites* and *Caphtorims*. The earlier part of their history is, like that of most other nations, very obscure and uncertain. The authors of the Universal History tell us, that they were descended from the Casluhim partly, and partly from the Caphtorim, both from the loins of Mizraim the son of Ham, the son of Noah. Moses tells us (Deut xi. 23.), that they drove out the Avim or Avites even to Azzah or Gazah, where they settled; but when this happened cannot be determined. On the whole, however, our learned authors are clearly of opinion, that the Casluhim and Caphtorim, from whom the Philistines are descended, came originally from Egypt, and called the country which they had conquered by their own name (See PALESTINE). Many interpreters, however, think, that Caphtor was but another name for Cappadocia, which they imagine to have been the original country of the Philistines. But Father Calmet, in a particular dissertation prefixed to the first book of Samuel, endeavours to show that they were originally of the isle of Crete. The reasons which led him to think that Caphtor is the isle of Crete are as follow: The Philistines were strangers in Palestine, as appears in various parts of Scripture; such as Gen. x. 14. Deut. ii. 23. Jer. xlvii. 4. and Amos ix. 7. whence the Septuagint always translate this name *Strangers*. Their proper name was Cherethims, for Ezekiel (xxv. 16.), speaking against the Philistines, has these words, "I will stretch out mine hand upon the Philistines, and I will cut off the Cherethims, and destroy the remnant of the sea coast." Zephaniah (ii. v.), inveighing against the same people, says, "Woe unto the inhabitants of the sea-coasts, the nation of the Cherethites." And Samuel (Book I. xxx. 14.) says, that the Amalekites made an irruption into the country of the Cherethites, that is to say, of the Philistines, as the sequel of the discourse proves. And afterwards the kings of Judah had foreign guards called the *Cherethites* and *Pelethites*, who were of the number of the Philistines (2 Sam. xv. 18.). The Septuagint, under the name *Cherethites*, understood the *Cretans*; and by *Cherith* they understood *Crete*. Besides the Scripture says, that the Philistines came from the isle of Caphtor. Now we see no island in the Mediterranean wherein the marks whereby the Scripture describes Caphtor and Cherethim agree better than in the isle of Crete. The name *Cretim* or *Cherethim*, is the same with that of *Cretenses*. The Cretans are one of the most ancient and celebrated people which inhabited the islands of the Mediterranean. They pretended to have been produced

duced originally out of their own soil. This island was well peopled in the time of the Trojan war. Homer calls it the island with a hundred cities. The city of Gaza in Palestine went by the name of *Minoa (Steph. Byzant. in Gaza)*, because Minos king of Crete coming into that country, called this ancient city by his own name.

Herodotus acknowledges that the Cretans were originally all barbarians, and did not come from Greece. Homer says, that a different language was spoken in the isle of Crete; that there were Greeks there, true or ancient Cretans, Pelagians, &c. The ancient Cretans are the same as the Cherethites, the Pelasgians as the Philistines or Pelethites of the Scripture: their language was the same with that of the Canaanites or Phœnicians, that is, Hebrew: they were descended, as well as Canaan, from Ham, by Mizraim (Gen. x. 6, 13, 14.). The manners, arms, religion, and gods of the Cretans and Philistines were the same. The arms of the one and the other were bows and arrows. Dagon the god of the Philistines was the same as the Dictynna of the Cretans.

Whether these arguments are convincing, it is not for us to determine; but Wells does not think they are, as he is of the same opinion with the authors of the Universal History, who say, that *Coptus*, the name of an old city of Egypt, is a corruption of the ancient *Caphtor*. It is not, however, of great importance to determine whether they came from Crete, from Cappadocia, or from Egypt: they had certainly been a considerable time in the land of Canaan, when Abraham arrived there in the year of the world 2083. They were then a very powerful people, were governed by kings, and in possession of several considerable cities. The race of kings then in power were honoured with the title of *Abimelech*. This race, however, was but of short duration; for their monarchy became an aristocracy of five lords, who were, as far as we can discover, partly independent of each other, though they acted in concert for the common cause. This form of government was again succeeded by another race of kings, distinguished by the title of *Achish*, though they also bore that of *Abimelech*. The kings were always under great limitations. The Philistines appear to have been a very warlike people, industrious, and lovers of freedom; they did not circumcise, and in the early periods of their history held adultery in the greatest abhorrence. "Their character (say the authors of the Universal History) must be considered at different periods; for we may say they were not always the same people. In the days of Abraham and Isaac, they were without all doubt a righteous and hospitable nation: but afterwards a revolution in government, religion, and morals, may have ensued. From thenceforward they became like other idolatrous nations; the same enormities crept in and prevailed among them.

Anc. part, vol. i. p. 408, &c.

They are constantly mentioned in Scripture as strangers; and, though possessed of a very considerable part of the Land of Promise, yet God would never suffer them to be driven out, they being Egyptians by descent, and not original natives, whose land only was promised to Abraham and his seed. Their arrogance and ambition were great; and so irreconcileable was their enmity (A) to the Israelites, that one would be almost tempted to think they were created on purpose to be a thorn in their sides; for though the hand of God was evidently against them several times, and particularly when they detained the ark, yet they hardened their hearts, and closed their eyes against conviction. They seem to have entertained a very fond veneration for their deities, in which they persisted, though they were eye witnesses of the shame and ignominy which befel them in the presence of the captive ark; nay, they were so biassed in their favour, as to imagine that their gods might prevail against Him who had in so glaring a manner put them to shame and disgrace. They were much engaged in trade; which, considering their situation, they may have exercised from the beginning; but, by the accession of the fugitive Edomites in David's time, they rose to so great a reputation as merchants, that the Greeks, it seems, preferred them to all other nations in that respect, and from them called all the country bordering on theirs *Palestine*. Their language was not so different from that spoken by the Hebrews as to cause any difficulty for them to converse together, as will be perceived by their intercourse with Abraham and Isaac; so that, in all this region, the several nations spoke one and the same tongue, perhaps with some variation of dialect. They had doubtless the arts and sciences in common with the most learned and ingenious among their contemporaries, and perhaps some of them in greater perfection. They had giants among them; but whether they were originally of the breed of the Anakims, who retired hither when they were expelled from Hebron, or were sprung from accidental births, is not easily determined. We must not forget, that the invention of the bow and arrow is ascribed to this people.

"Their religion was different at different times; under their first race of kings, they used the same rites with the Hebrews. Abimelech, in the sin he had like to have committed with Sarah, through Abraham's timidity, was favoured with a divine admonition from God; and, by his speech and behaviour at that time, it seems as if he had been used to converse with the Deity. In after-times, they fell into endless superstitions, and different kinds of idolatry; each of the principal or five cities seemed to have an idol of its own. Marna, Marnas, or Marnash, was worshipped at Gaza, and is said to have migrated into Crete, and to have become the Cretan Jupiter. Dagon was worshipped at Azotus; he seems to have been the greatest, the most ancient, and most

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(A) "From a passage in Chronicles, it is guessed to have been of very ancient date; where it is said, that 'the men of Gath slew the children of Ephraim, who would have taken their cattle from them.' This incident is nowhere else to be found; and there are various notions concerning the sense in which we must take this passage. As to the time of the transaction, most people allow it to have been while the children of Israel were sojourners in Egypt. It plainly appears, by the next verse, that Ephraim himself was living at that period. The Targum supposes his children miscomputed the time they were to serve in Egypt, and began too early an attempt upon their Promised Land."

most favourite god they had; to which may be added, that he perhaps subsisted the longest of any that did not straggle out of the country. To him they ascribed the invention of bread-corn, or of agriculture, as his name imports. We cannot enter into the common notion of his being represented as a monster, half man half fish; nor consequently into another, almost as common, that he is the same with the Syrian goddess Derceto, who, we are told, was represented under some such mixed form. Our opinion is, that this idol was in shape wholly like a man; for we read of his head, his hands, and his feet. He stood in a temple at Azotus, and had priests of his own who paid him a very constant attendance. Next to Dagon was Baalzebub the god of Ekron. In the text of the New Testament he is called *Beelzebub*, and the *prince of devils*. His name is rendered *lord of flies*; which by some is held to be a mock appellation bestowed on him by the Jews; but others think him so styled by his worshippers, as Hercules Apomyios and others were, from his driving those insects away; and urge, that Ahaziah, in his sickness, would scarcely have applied to him, if his name had carried in it any reproach. But it must be remembered, it is the sacred historian that makes use of that contemptuous term in derision; whereas the idolatrous monarch, who was one of his votaries, might call him by his common name, supposed to have been *Baal-zeboath*, 'the lord of armies,' or *Baal-shamin*, 'lord of heaven,' or some other bordering on Baal-zebub. How, or under what form he was represented is uncertain: some place him on a throne, and attire him like a king; others paint him as a fly. Not to dwell on this obscurity, it appears that he became an oracle of the highest repute for omniscience and veracity; that he had priests of his own; and that he, in the middle times at least, was much sought after by those who were anxious about futurity. Derceto we take certainly to have been the goddess of Ascalon; but we are supported by profane authority, without the least countenance from Scripture. Gath is seemingly the only city of all the five unprovided with a deity; wherefore, as the Scripture declares, that Ashtaroth, or Astarte, was worshipped by this people, we are ready to place her at Gath, and the rather, as this of all their cities may have had most communication with Sidon. To speak in general concerning their religious rites and ceremonies, which is all we can do, they seem to have erected very large and spacious temples, or very wide halls, for the celebration of their solemn seasons and festivals (for such they surely had); their religious offices were attended with much pomp, and a great concourse from all parts; and they presented their gods with the chief part of their spoil, and carried them about with them when they went to war. We do not find in Scripture that they sacrificed their children; and yet the Curetes (B) are said to be their descendants."

With respect to the history of this extraordinary people, we find from the above extract, that they were not comprehended in the number of nations devoted to extermination, and whose territory the Lord had abandoned to the Hebrews; nor were they of the cursed seed of Canaan. However, Joshua did not forbear to give their lands to the Hebrews, and to set upon them by command from the Lord, because they possessed a country which was promised to the people of God (Josh. xv. 45.—47. and xiii. 2, 3.). But these conquests of Joshua must have been ill maintained, since under the Judges, under Saul, and at the beginning of the reign of David, the Philistines oppressed the Israelites. True it is, Shamgar, Samson, Samuel, and Saul, made head against them, but did not reduce their power; and they continued independent down to the reign of David, who subjected them to his government.

They continued in subjection to the kings of Judah down to the reign of Jehoram, son of Jehoshaphat; that is, for about 246 years. However, Jehoram made war against them, and probably reduced them to his obedience again; because it is observed in Scripture, that they revolted again from Uzziah; and that this prince kept them to their duty during the time of his reign (2 Chron. xxi. 16. and xxvi. 6, 7.). During the unfortunate reign of Ahaz, the Philistines made great havock in the territories of Judah; but his son and successor Hezekiah subdued them (2 Chron. xxviii. 18. and 2. Kings xviii. 8.). Lastly, they regained their full liberty under the latter kings of Judah; and we may see by the menaces denounced against them by the prophets Isaiah, Amos, Zephaniah, Jeremiah, and Ezekiel, that they brought a thousand hardships and calamities upon the children of Israel: for which cruelties God threatened to punish them. Esarhaddon besieged Ashdod or Azoth, and took it (Isa. xx. 1.). And according to Herodotus, Psammeticus king of Egypt took the same city, after a siege of 29 years. There is great probability, that Nebuchadnezzar, when he subdued the Ammonites, Moabites, Egyptians, and other nations bordering upon the Jews, reduced also the Philistines. After this, they fell under the dominion of the Persians; then under that of Alexander the Great, who destroyed the city of Gaza, the only city of Phœnicia that durst oppose him. After the persecution of Antiochus Epiphanes, the Asmonæans subjected under their obedience several cities of the Philistines; and Tryphon gave to Jonathan Maccabæus the government of the whole coast of the Mediterranean, from Tyre as far as Egypt, which included all the country of the Philistines.

PHILLYREA, MOCK-PRIVET; a genus of plants belonging to the diandria class. See BOTANY *Index*.

PHILO, an ancient Greek writer, was of a noble family among the Jews, and flourished at Alexandria during the reign of Caligula. He was the chief of an embassy sent to Rome about the year 42, to plead the cause of the Jews against Apion, who was sent by the Alexandrians to charge them with neglecting the honours due to Cæsar. Caligula, however, would not allow him to speak, and behaved to him in such a manner that Philo was

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(B) "The Curetes sacrificed their children to Saturn; and from the similitude this name bears to Cherethites or Philistines, it has been advanced that they are the same people; but as we have no warrant for saying the Philistines practised so barbarous and unnatural a custom, we may venture to pronounce, that they learned it not from them, but borrowed it elsewhere."

was in considerable danger of losing his life. Others again tell us that he was heard; but that his demands were refused. He afterwards went to Rome in the reign of Claudius; and there, Eusebius and Jerome inform us, he became acquainted with St Peter, with whom he was on terms of friendship. Photius adds, that he became a Christian, and afterwards, from some motive of resentment, renounced it. Great part of this, however, is uncertain, for few believe that St Peter was at Rome so early as the reign of Claudius, if he ever was there at all.

Philo was educated at Alexandria, and made very great progress in eloquence and philosophy. After the fashion of the time, he cultivated, like many of his nation and faith, the philosophy of Plato, whose principles he so thoroughly imbibed, and whose manner he so well imitated, that it became a common saying, "Aut Plato philonizat, aut Philo platonizat." Josephus says, he was a man "eminent on all accounts:" and Eusebius describes him, "copious in speech, rich in sentiments, and sublime in the knowledge of holy writ." He was, however, so much immersed in philosophy, particularly the Platonic, that he neglected the Hebrew language, and the rites and customs of his own people. Scaliger says, that Philo "knew no more of Hebrew and Syriac than a Gaul or a Scythian." Grotius is of opinion, that "he is not fully to be depended on, in what relates to the manners of the Hebrews:" and Cudworth goes further; for "though a Jew by nation (says he), he was yet very ignorant of Jewish customs." Fabricius thinks differently; for though he allows some inadvertencies and errors of Philo with regard to these matters, yet he does not see a sufficient foundation on which to charge so illustrious a doctor of the law with ignorance. He allows, however, that Philo's passion for philosophy had made him more than half a Pagan; for it led him to interpret the whole law and the prophets upon Platonic ideas; and to admit nothing as truly interpreted which was not agreeable to the principles of the academy. Besides, this led him farther; he turned every thing into allegory, and deduced the darkest meanings from the plainest words. This most pernicious practice ORIGEN, it is known, imitated, and exposed himself by it to the scoffs of Celsus and of Porphyry. Philo's writings abound with high and mystical, new and subtile, far-fetched and abstracted, notions; and indeed the doctrines of Plato and Moses are so promiscuously blended, that it is not an easy matter to assign to each his principles. There are certainly, however, in his works many excellent things. Though he is continually Platonising and allegorising the Scriptures, he abounds with fine sentiments and lessons of morality; and his morals are rather the morals of a Christian than of a Jew. History, together with his own writings, give us every reason to believe that he was a man of great prudence, constancy, and virtue.

His works were first published in Greek by Turnebus at Paris 1552. A Latin traslation made by Gelenius was afterwards added, and printed several times with it. The Paris edition of 1640 in folio was the best for a whole century; which made Cotelerius say, that "Philo was an author that deserved to have a better text and a better version." In 1742, a handsome edition of his work was published at London by Dr Mangey in two volumes folio; which is certainly preferable if it were only for the paper and print, but it is not so good a one as Philo deserves.

Many of our readers may be desirous of further details respecting this celebrated man; we refer such therefore to Josephus's Antiquities, Eusebius's Ecclesiastical History, St Jerome's work *De Scriptoribus Ecclesiasticis*, *Fabricius Bibl. Græc. Cave Hist. Liter.* and vol. ii. of Monuments of the Greek Church.

PHILOCLES, an admiral of the Athenian fleet during the Peloponnesian war. He recommended to his countrymen to cut off the right hand of such of the enemies as were taken, that they might be rendered unfit for service. His plan was adopted by all the ten admirals except one; but their expectations were frustrated, and instead of being conquerors they were totally defeated at Ægospotamus by Lysander, and Philocles was put to death with the rest of his colleagues.

PHILOCTETES, in fabulous history, the son of Pæan, was the faithful companion of Hercules; who at his death obliged him to swear not to discover the place where his ashes were interred, and presented him with his arrows dipped in the Hydra's blood. The Greeks at the siege of Troy being informed by an oracle that they could never take that city without those fatal arrows, went to Philoctetes, and insisted upon his discovering where he had left his friend; when Philoctetes, to evade the guilt of perjury, let them know where Hercules was intombed, by stamping upon the place: but he was punished for the violation of his oath, by dropping an arrow upon that foot; which, after giving him great agony, was at length cured by Machahon. He was afterwards taken by Ulysses to the siege of Troy, where he killed Paris with one of his arrows.

PHILOLAUS, of Crotona, was a celebrated philosopher of antiquity, of the school of Pythagoras, to whom that philosopher's *Golden Verses* have been ascribed. He made the heavens his principal object of contemplation; and has been idly (A) supposed to have been the author of that true system of the world which Copernicus afterwards revived. This made Bullialdus place the name of Philolaus at the head of two works, written to illustrate and confirm that system.

"He was (says Dr Enfield) a disciple of Archytas, and flourished in the time of Plato. It was from him that Plato purchased the written records of the Pythagorean system, contrary to an express oath taken by the society of Pythagoreans, pledging themselves to keep secret the mysteries of their sect. It is probable, that among these books were the writings of Timæus, upon which Plato formed the dialogue that bore his name. Plutarch relates, that Philolaus was one of the persons who escaped from the house which was burned by Cylon, during the life of Pythagoras; but this account cannot be correct. Philolaus was contemporary with Plato, and therefore certainly not with Pythagoras. Interfering

Hist. of Philosoph.

(A) We say idly, because there is undoubted evidence that Pythagoras learned that system in Egypt. See PHILOSOPHY.

Philolaus. terfering in affairs of state, he fell a sacrifice to political jealousy.

"Philolaus treated the doctrine of nature with great subtlety, but at the same time with great obscurity; referring every thing that exists to mathematical principles. He taught, that reason, improved by mathematical learning, is alone capable of judging concerning the nature of things; that the whole world consists of infinite and finite; that number subsists by itself, and is the chain which by its power sustains the eternal frame of things; that the Monad is not the sole principle of all things, but that the Binary is necessary to furnish materials from which all subsequent numbers may be produced; that the world is one whole, which has a fiery centre, about which the ten celestial spheres revolve, heaven, the sun, the planets, the earth, and the moon; that the sun has a vitreous surface, whence the fire diffused through the world is reflected, rendering the mirror from which it is reflected visible; that all things are preserved in harmony by the law of necessity; and that the world is liable to destruction both by fire and by water. From this summary of the doctrine of Philolaus it appears probable, that, following Timæus, whose writings he possessed, he so far departed from the Pythagorean system as to conceive two independent principles in nature, God and Matter, and that it was from the same source that Plato derived his doctrine upon this subject." Philolaus.

PHILOLOGY.

1 Definition. PHILOLOGY is compounded of the two Greek words φιλος and λογος, and imports "the desire of investigating the properties and affections of *words.*" The sages of Greece were, in the most ancient times, denominated Σοφοι, that is, *wise men*. Pythagoras renounced this pompous appellation, and assumed the more humble title of φιλοσοφος, that is, *a lover of wise men*. The learned Greeks were afterwards called *philosophers*; and in process of time, in imitation of this epithet, the word *philologer* was adopted, to import "a man deeply versed in languages, etymology, antiquities, &c." Hence the term *philology*, which denotes the science that we propose briefly to discuss in the following article.

Though philology, in its original import, denoted only the study of words and language, it gradually acquired a much more extensive, and at the same time a much more useful, as well as more exalted, signification. It

2 Objects and uses of philology. comprehended the study of grammar, criticism, etymology, the interpretation of ancient authors, antiquities; and, in a word, every thing relating to ancient manners, laws, religion, government, language, &c. In this enlarged sense of the word, philology becomes a science of the greatest utility; opens a wide field of intellectual investigation; and indeed calls for a more intense exertion of industry, and multifarious erudition, than most of those departments of literature which custom hath dignified with more high-sounding names. It is indeed apparent, that, without the aid of philological studies, it is impossible upon many occasions, to develope the origin of nations; to trace their primary frame and constitution; to discover their manners, customs, laws, religion, government, language, progress in arts and arms; or to learn by what men and what measures the most celebrated states of antiquity rose into grandeur and consideration. The study of history, so eminently useful to the legislator, the divine, the military man, the lawyer, the philosopher, and the private gentleman who wishes to employ his learned leisure in a manner honourable and improving to himself, and useful to his country, will contribute very little towards enlightening the mind without the aid of philological researches. For these reasons we shall endeavour to explain the various branches of that useful science as fully and as intelligibly as the nature of the present undertaking will permit.

Most of the branches of philology have been already canvassed under the various heads of CRITICISM, ETYMOLOGY, GRAMMAR, LANGUAGE, &c. There still remains one part, which has either been slightly touched upon, or totally omitted, under the foregoing topics: we mean, the nature and complexion of most of the oriental tongues; as also some of the radical dialects of the languages of the west. As we would willingly gratify our readers of every description to the utmost of our power, we shall endeavour in this place to communicate to them as much information upon that subject as the extent of our reading, and the limits prescribed one single article, will permit. 3 Object of this article.

Before we enter upon this subject, we must observe, that it is not our intention to fill our pages with a tedious, uninteresting, catalogue of barbarous languages, spoken by savage and inconsiderable tribes, of which little, or perhaps nothing, more is known than barely their names. Such an enumeration would swell the article without communicating one single new idea to the reader's antecedent stock. We shall therefore confine our inquiries to such languages as have been used by considerable states and societies, and which of consequence have acquired a high degree of celebrity in the regions of the east.

What was the antediluvian language, or whether it was divided into a variety of dialects as at this day, can only be determined by the rules of analogy; and these will lead us to believe, that whatever might have been the primitive language of mankind, if human nature was then constituted as it is at present, a great variety of dialects must of necessity have sprung up in the space of near 2000 years. If we adopt the Mosaic account of the antediluvian events, we must admit that the descendants of Cain for some ages lived separated from those of Seth. Their manner of life, their religious ceremonies, their laws, their form of government, were probably different, and these circumstances would of course produce a variety in their language. The posterity of Cain were an inventive race. They found out the art of metallurgy, music, and some think of weaving; and in all probability many other articles condu- 4 Variety of dialects before the deluge.

3 especially among the children of Cain.

cive to the ease and accommodation of life were the produce of their ingenuity. A people of this character must have paid no small regard to their words and modes of expression. Wherever music is cultivated, language will naturally be improved and refined. When new inventions are introduced, a new race of words and phrases of necessity spring up, corresponding to the recent stock of ideas to be intimated. Besides, among an inventive race of people, new vocables would be continually fabricated, in order to supply the deficiencies of the primitive language, which was probably scanty in words, and its phraseology unpolished. The Cainites, then, among their other improvements, cannot well be supposed to have neglected the cultivation of language.

6 Origin of writing.

Many conjectures have been hazarded both by ancient and modern authors with respect to the origin of writing; an art nearly connected with that of speaking. According to Pliny*, "the Assyrian letters had always existed; some imagined that letters had been invented by the Egyptian Mercury; others ascribed the honour of the invention to the Syrians." The truth seems to be, that letters were an antediluvian invention, preserved among the Chaldeans or Assyrians, who were the immediate descendants of Noah, and inhabited these very regions in the neighbourhood of which the ark rested, and where that patriarch afterwards fixed his residence. This circumstance, we think, affords a strong presumption that the use of letters was known before the deluge, and transmitted to the Assyrians and Chaldeans by Noah their progenitor, or at least by their immediate ancestors of his family. If, then, the art of writing was an antediluvian invention, we think that in all probability it originated among the posterity of Cain.

The descendants of Seth, according to the oriental tradition, were chiefly addicted to agriculture and tending of cattle. They devoted a great part of their time to the exercises of piety and devotion. From this circumstance they came to be distinguished by the title of the (A) *sons of God*. According to this description, the Sethites were a simple (B), unimproved race of people till they mingled with the race of Cain; after which period they at once adopted the improvements and the vices of that wicked family.

It is not, however, probable, that all the descendants of Seth, without exception, mingled with the Cainites. That family of which Noah was descended had not incorporated with the race of Cain: it was, according to the sacred historian, lineally descended from Seth, and had preserved the worship of the true God, when, it is probable, the greatest part of mankind had apostatised and become idolaters (C). Along with the true religion, the progenitors of Noah had preserved that simplicity of manners and equability of character which had distinguished their remote ancestors. Agriculture and rearing cattle had been their favourite occupations. Accordingly we find, that the patriarch Noah, immediately "after the deluge," became a husbandman, and "planted a vineyard." The chosen patriarchs, who doubtless imitated their pious ancestors, were shepherds, and employed in rearing and tending cattle. Indeed there are strong presumptions that the Chaldeans, Assyrians, Syrians, Canaanites, and Arabians, in the earliest ages followed the same profession.

From this deduction, we imagine it is at least probable, that the ancestors of Noah persisted in the observance of the same simplicity of manners which had been handed down from Adam to Seth, and from him to Enoch, Methuselah, Lamech, and from this last to Noah. According both to scripture and tradition, innovations were the province of the Cainites, while the descendants of Seth adhered to the primitive and truly patriarchal institutions.

7 The original language preserved in the family from which Noah sprung.

If these premises are allowed the merit of probability, we may justly infer that the language of Noah, whatever it was, differed very little from that of Adam (D); and that if it is possible to ascertain the language of the former, that of the latter will of course be discovered. We shall then proceed to throw together a few observations relating to the language of Noah, and leave our readers to judge for themselves. We believe it will be superfluous to suggest, that our intention in the course of this deduction is, if possible, to trace the origin and antiquity of the Hebrew tongue; and to try to discover whether that language, or any of its sister dialects, may claim the honour of being the original language of mankind.

Whatever may have been the dialect of Noah and his family, that same dialect, according to the Mosaic account, must have obtained, without any alteration, till the era of the building of the tower of Babel.—Upon this occasion a dreadful convulsion took place: the language of mankind was confounded, and men were *scattered abroad upon the face of all the earth.*

8 Confusion at the tower of Babel.

How far this catastrophe (E) extended, is not the business of the present inquiry to determine. One thing is certain beyond all controversy, namely, that the languages of all the nations which settled near the centre of population were but slightly affected by its influence. A very judicious writer has observed †, that 3000 years after, the inhabitants of those countries exhibited a very strong resemblance of cognation, "in their *language*, manner

* *Nat Hist.* lib. vii. cap. 56.

† *Strabo.*

(A) From this passage (Gen. chap. vi. verse 2.) misunderstood, originated the absurd idea of the connection between angels and mortal women. See *Joseph. Antiq. Jud.* lib. i. cap. 4. See *Euseb. Chron.* lib. i. All the fathers of the church, almost without exception, adopted this foolish notion. See also *Philo-Jud.* p. 198. edit. Turn. Paris 1552.

(B) The orientals, however, affirm, that Seth, whom they call *Edris*, was the inventor of astronomy.

(C) We think it highly probable that idolatry was established before the flood; because it prevailed almost immediately after that catastrophe. See POLYTHEISM.

(D) For the first language communicated to Adam, see the article on LANGUAGE; also *Schuckford's Connect.* vol. i. lib. ii. p. 111. *et seq.*

(E) Josephus and the fathers of the church tell us, that the number of languages produced by the confusion of tongues was 72; but this is a mere rabbinical legend.

manner of living, and the lineaments of their bodies. At the same time he observes, that the resemblance in all those particulars was most remarkable among the inhabitants of Mesopotamia." This observation, with respect to language, will, we doubt not, be vouched by every one of our readers who has acquired even a superficial knowledge of the languages current in those quarters at a very early period.

It appears, then, that the languages of the Armenians, Syrians, Assyrians, Arabians, and probably of the Chanaanim, did not suffer materially by the confusion of tongues. This observation may, we imagine, be extended to many of the dialects (F) spoken by the people who settled in those countries not far distant from the region where the sacred historian has fixed the original seat of mankind after the deluge. The inference then is, that if Noah and his family spoke the original language of Adam, as they most probably did, the judgement which effected the confusion of tongues did not produce any considerable alteration in the language of such of the descendants of Noah as settled near the region where that patriarch had fixed his residence after he quitted the ark.

9 Only a part of mankind engaged in building the tower,

But supposing the changes of language produced by the catastrophe at the building of the tower as considerable as has ever been imagined, it does not, after all, appear certain, that all mankind, without exception, were engaged in this impious project. If this assertion should be well founded, the consequence will be, that there was a chosen race who did not engage in that enterprise. If there was such a family, society, or body of men, it will follow, that this family, society, &c. retained the language of its great ancestor without change or variation. That such a family did actually exist, is highly probable, for the following reasons.

1. We think there is reason to believe that Ham, upon the heavy curse denounced upon him by his father *, retired from his brethren, and fixed his residence elsewhere. Accordingly we find his descendants scattered far and wide, at a very great distance from the Gordyæan mountains, where the ark is generally supposed to have rested immediately after the flood. Some of them we find in Chaldæa, others in Arabia Felix, others in Ethiopia (G), others in Canaan, and others in Egypt; and, finally, multitudes scattered over all the coast of Africa. Between these countries were planted many colonies of Shemites, in Elam, Assyria, Syria, Arabia, &c. We find, at the same time, the descendants of Shem and Japhet settled, in a great degree, contiguous to each other. This dispersion of the Hamites, irregular as it is, can scarce, we think, have been accidental; it must have been owing to some uncommon cause, and none seems more probable than that assigned above. If, then, the descendants of Ham separated early, and took different routes, as from their posterior situations it appears they did, they could not all be present at the building of the tower.

* Gen. ix. 25.

10 and those not the descendants of Shem.

2. It is not probable that the descendants of Shem were engaged in this undertaking, since we find that they were not *scattered abroad upon the face of all the earth.* The children of Shem were † Elam, Ashur, Arphaxad, Lud, and Aram. Elam settled near the mouth of the river Tigris, in the country which, by the Gentile writers, was called *Elymais.* Above him, on the same river, lay the demesne of Ashur, on the western side. In like manner, upon the same river, above him, was situated Aram, who possessed the country of Aramea; and opposite to him was Arphaxad, or Arbaces, or Arbaches, and his country was denominated *Arphachites.* Lud, as some think, settled in Lydia, among the sons of Japhet; but this opinion seems to be without foundation (H). Here, then, there is a dispersion, but such as must have originated from the nature of the thing. The four, or rather the five brothers, all settled contiguous, without being *scattered abroad upon the face of the whole earth.* Besides, there was no confusion of language among these tribes: they continued to use one and the same *lip* through many succeeding generations.

† Chap. x. verse 22.

11 The language of Adam preserved in the family of Shem.

From these circumstances it appears, that the posterity of Shem were not involved in the guilt of the builders of the tower, and of consequence did not undergo their punishment. If then the language of the Shemites was not confounded upon the erection of the tower, the presumption is, that they retained the language of Noah, which, in all probability, was that of Adam. Some dialectical differences would in process of time creep in, but the radical fabric of the language would remain unaltered.

3. The posterity of Shem appear in general to have cultivated the pastoral life. They imitated the style of living adopted by the antediluvian posterity of Seth. No sooner had Noah descended from the ark, than he became *Ish ha Adamah*, a man of the earth; that is, a husbandman, and planted a vineyard. We find that some ages after, Laban the Syrian had flocks and herds; and that the chief wealth of the patriarch Abraham and his children consisted in their flocks and herds. Even his Gentile descendants, the Ishmaelites and Midianites, seem to have followed the same occupation. But people of this profession are seldom given to changes: their wants are few, and of consequence they are under few or

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(F) The language of the Medes, Persians, Phœnicians, and Egyptians, very much resembled each other in their original complexion; and all had a strong affinity to the Hebrew, Chaldean, Syriac, &c. See Walton's *Proleg.*; Gale's *Court of the Gent.* vol. i. lib. i. ch. 11. p. 70. *et seq.*; Boch. *Phalec* and *Chanaan, pass.* To these we may add the Greek language, as will appear more fully below.

(G) Josephus informs us, that all the nations of Asia called the Ethiopians *Cushim*, lib. i. cap. 7.

(H) The ancient name of Lydia was *Mæonia.* See Strabo *Casaub*, lib. xiii. p. 586. chap. 7. *Rhod.* 577. The Lydians were celebrated for inventing games; on which account they were nicknamed by the Æolian Greeks Λυδοι, *Lydi* or *Ludi*, from the Hebrew word *lutz*, *ludere*, *illudere*, *deridere.* We find (Ezek. chap. xxvii. ver. 10.) the men of Elam and the men of Lud joined in the defence of Tyre; which seems to intimate, that the Elamites and Ludim were neighbours. If this was actually the case, then Lud settled in the same quarter with his brothers.

or no temptations to deviate from the beaten track. This circumstance renders it probable that the language of Noah, the same with that of Adam, was preserved with little variation among the descendants of Arphaxad down to Abraham.

12 down to Abraham.

We have observed above, that Ham, upon the curse denounced against him by his father, very probably left the society of his other brothers, and emigrated elsewhere, as Cain had done in the antediluvian world. There is a tradition still current in the East, and which was adopted by many of the Christian fathers (I), that Noah, in the 930th year of his life, by divine appointment, did, in the most formal manner, divide the whole terraqueous globe among his three sons, obliging them that they would take an oath to stand by the decision. Upon this happened a migration at the birth of Peleg, that is, about three centuries after the flood. It is affirmed that Nimrod the arch-rebel disregarded this partition, and encroached upon the territory of Ashur, which occasioned the first war after the flood.

The Greeks had acquired some idea of this partition, which they supposed to have been between Jupiter ‡, Neptune, and Pluto. Plato seems to have heard of it (K): "For (says he) the gods of old obtained the dominion of the whole earth, according to their different allotments. This was effected without any contention, for they took possession of their several provinces in a fair and amicable way, by lot." Josephus §, in his account of the dispersion of mankind, plainly insinuates a divine destination; and Philo-Judæus (L) was of the same opinion before him.

‡ *Callimach. Hym. Hom. Iliad.* lib. xv.

§ *Ant. Jud.* lib. i. c. 5.

In consequence of this arrangement, the sons of Shem possessed themselves of the countries mentioned in the preceding pages: the posterity of Japhet had spread themselves towards the north and west; but the Hamites, who had separated from their brethren in consequence of the curse, not choosing to retire to their quarters, which were indeed very distant from the place where the ark rested, seized upon the land of Canaan (M). Perhaps, too, it might be suggested by some malicious spirits, that the aged patriarch was dealing partially when he assigned Ham and his posterity a quarter of the world to inhabit not only remote from the centre of population, but likewise sequestered from the rest of mankind (N).

Be that as it may, the children of Ham removed eastward, and at length descending from the Carduchean or Gordyæan mountains, directed their course westward, and arrived at the plains of Shinar, which had been possessed by the Ashurim ever since the era of the first migration at the birth of Peleg. The sacred historian informs us, that the whole *earth* "was of one language and of one speech;" that in journeying from the east, they lighted upon the plain of Shinar, and dwelt there. In this passage we find no particular people specified; but as we find Nimrod, one of the descendants of Ham, settled in that country, we are sure that they were the offspring of that patriarch. It would not, we think, be easy to assign a reason how one branch of the family of Ham came to plant itself in the midst of the sons of Shem by any other means but by violence.

13 The tower of Babel built by the children of Ham.

It is indeed generally supposed, that Nimrod, at the head of a body of the children of Ham, made war upon Ashur, and drove him out of the country of Shinar; and there laid the foundation of that kingdom, the beginning of which was Babel: that this chief, supported by all the Cushites, and a great number of apostates from the families of Shem and Japhet who had joined him, refused to submit to the divine ordinance by the mouth of Noah, with respect to the partition of the earth; and that he and his adherents were the people who erected the celebrated tower, in consequence of a resolution which they had formed to keep together, without repairing to the quarters assigned them by the determination of heaven. This was the crime which brought down the judgment of the Almighty upon them, by which they were *scattered abroad upon the face of all the earth.* The main body of the children of Shem and Japhet were not engaged in this impious undertaking; their language, therefore, was not confounded, nor were they themselves scattered abroad. Their habitations were contiguous; those of the Shemites towards the centre of Asia; the dwellings of Japhet were extended towards the north and north-west; and the languages of both these families continued for many ages without the least variation, except what time, climate, laws, religion, new inventions, arts, sciences, and commerce, &c. will produce in every tongue in a succession of years.

The general opinion then was, that none but the progeny of Ham and their associates were present at the building of the tower, and that they only suffered by the judgment (O) consequent upon that attempt. There are

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(I) *Epiph.* vol. i. p. 5. *ibid.* p. 709. where our learned readers will observe some palpable errors about *Rhinocorura*, &c. Euseb. *Chron.* p. 10. Syncellus, p. 89. Cedrenus *Chron. Pasch.* &c.

(K) Critias, vol. iii. page 109. *Serr.* Apollodorus mentions a time when the gods respectively selected particular cities and regions, which they were to take under their peculiar protection.

(L) Lib. x. p. 236. Turn. Paris 1552. We have a plain allusion to this distribution (Deut. ch. xxxii. ver. 7.). "When the most High divided to the nations their inheritance, when he separated the sons of Adam, he set the bounds of the people, according to the number of the children of Israel; for the Lord's portion is his people; Jacob is the lot of his inheritance." From this passage it appears, that the whole was arranged by the appointment of God, and that the land of Canaan was expressly reserved for the children of Israel. St Paul, Acts ch. xvii. ver. 16. speaks of this divine arrangement," God made of one blood all nations of men, for to dwell on all the face of the earth; and determined the bounds of their habitation."

(M) The ark, according to the most probable accounts, rested upon Mount Ararat in Armenia.

(N) We think it by no means improbable that Noah, well knowing the wickedness of the family of Ham, and especially their inclination to the idolatry of the antediluvians, might actually intend to separate them from the rest of mankind.

(O) Some learned men have imagined that this confusion of language, which the Hebrew calls of *Lip*, was only are even among the Pagans some allusions to the division of the world among the three sons of Noah. Many of the learned have imagined that this patriarch was Saturn; and that his three sons were Jupiter, Neptune, and Pluto, as has been observed above.

Berosus *, in his history of the Babylonians, informs us, that Noah, at the foot of Mount Baris or Luban, where the ark rested, gave his children their last instructions, and then vanished out of sight. It is now generally believed that the Xisuthrus of Berosus was Noah. Eupolemus †, another heathen writer, tells us, "that the city Babel was first founded, and afterwards the celebrated tower; both which were built by some of those people who escaped the deluge. They were the same with those who in after times were exhibited under the name of *giants*. The tower was at length ruined by the hand of the Almighty, and those giants were scattered over the whole earth." This quotation plainly intimates, that according to the opinion of the author, only the rascally mob of the Hamites, and their apostate associates, were engaged in this daring enterprise.

Indeed it can never be supposed that Shem, if he was alive at that period, as he certainly was, would co-operate in such an absurd and impious undertaking. That devout patriarch, we think, would rather employ his influence and authority to divert his descendants from an attempt which he knew was undertaken in contradiction to an express ordinance of Heaven: and it is surely very little probable that Elam, Ashur, Arphaxad, and Aram, would join that impious confederacy, in opposition to the remonstrances of their father.

The building of the tower, according to the most probable chronology, was undertaken at a period so late, that *all mankind* could not possibly have concurred in the enterprise.

Many of the fathers were of opinion, that Noah settled in Armenia, the country where the ark rested; and that his descendants did not leave that region for five generations ‡, during the space of 659 years. By this period the human race must have been so amazingly multiplied, that the plains of Shinar could not have contained them. According to the Samaritan Pentateuch, and the Septuagint version, Peleg was born in the 134th year of his father Eber. Even admitting the vulgar opinion, that the tower was begun to be built, and the dispersion consequent upon that event to have taken place at this era, the human race would have been by much too numerous to have universally concurred in one design.

From these circumstances, we hope it appears that the whole mass of mankind was not engaged in building the tower; that the language of all the human race was not confounded upon that occasion; and that the dispersion reached only to a combination of Hamites, and of the most profligate part of the two other families, who had joined their wicked confederacy.

11
Therefore the original language preserved in the other two families.

We have pursued this argument to considerable length, because some have inferred, from the difference in languages existing at this day, that mankind cannot have sprung from two individuals; because from the connection still existing among languages, some have been bold enough to question the fact, though plainly recorded in sacred history; and lastly, because we imagine that some of our readers, who do not pretend to peruse the writings of the learned, may be gratified by seeing the various opinions respecting the confusion of tongues, and the dispersion of mankind, collected into one mass, equally brief, we hope, and intelligible; and this view of these opinions, with the foundations on which they respectively rest, we think may suffice to prove, that the language of Noah was for some ages preserved unmixed among the descendants of both Shem and Japhet.

To gratify still farther such of our curious readers as may not have access to more ample information, we shall in this place exhibit a brief detail of the circumstances which attended this fatal attempt. The people engaged in it have been held up as a profligate race. The Almighty himself denominates them "*the children of men*," which is the very appellation by which the antediluvian sinners were characterised; *the sons of God saw the daughters of men*, &c. Their design in raising this edifice was "*to make them a name, and to prevent their being scattered abroad upon the face of the whole earth* *."

Whatever resolution the rest mankind might take, they had determined to maintain themselves on that spot. The tower was intended as a centre of union, and perhaps as a fortress of defence. Such a stupendous fabric, they imagined, would immortalize their memory, and transmit the name of their confederacy with eclat (P) to future ages. This design plainly intimates, that there was only a party concerned in the undertaking, since, had all mankind been engaged in it, the purpose would have been foolish and futile. Again, they intended, by making themselves *a name*, to prevent their being scattered abroad upon the face of the earth. This was an act of rebellion in direct contradiction to the divine appointment, which constituted their crime, and brought down the judgment of Heaven upon their guilty heads. The consequence of the confusion of languages was, that the projectors left off to build (Q), and were actually scattered abroad, contrary to their intention.

15
Pagan tradition concerning the tower of Babel.

Abydenus, in his Assyrian Annals, records, that the (R) "tower was carried up to heaven; but that the gods

* Euseb. Chron.

† Euseb. Prep. Ev. lib. 9.

‡ Epiph. Hæres. lib. 1.

* Gen. chap. xi.

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a temporary failure of pronunciation, which was afterwards removed. This they are led to conclude, from the agreement of the languages of these people in after times.

(P) Many foolish and absurd notions have been entertained concerning this structure. Some have imagined that they meant to take shelter there in case of a second deluge; others, that it was intended for idolatrous purposes; others, that it was to be employed as an observatory. Its dimensions have likewise been most extravagantly magnified. Indeed Strabo, lib. 16. mentions a tower of immense size remaining at Babylon in his time, the dimensions of which were a stadium every way. This, however, seems to have been the remains of the temple of Bel or Belus.

(Q) For a description of the tower, see the article BABEL.

(R) See the Greek original of this quotation, Euseb. Chron. lib. 1. page 73.

gods ruined it by storms and whirlwinds, and overthrew it upon the heads of those who were employed in the work, and that the ruins of it were called *Babylon*. Before this there was but one language subsisting among men: but now there arose πολυθρηφωνη, *a manifold speech;* and he adds, that a war soon after broke out between (S) Titan and Cronus." (T) The Sybilline oracles give much the same account of this early and important transaction.

"Justin * informs us, that the Phœnicians who built Tyre were driven from Assyria by an earthquake. These Phœnicians were the descendants of Mizraim the youngest son of Ham; and were, we think, confederates in building the tower, and were driven away by the catastrophe that ensued. Many other allusions to the dispersion of this branch of the family occur in Pagan authors, which the limits to be observed in an inquiry of this nature oblige us to omit. Upon the whole, we think it probable that the country of Shinar lay desolate for some time after this revolution; for the dread of the judgment inflicted upon the original inhabitants would deter men from settling in that inauspicious region. At last, however, a new colony arrived, and Babel, or Babylon, became the capital of a flourishing kingdom.

Our readers, we believe, will expect that we should say something of Nimrod the mighty hunter, who is generally thought to have been deeply concerned in the transactions of this period. According to most authors, both ancient and modern, this patriarch was the leader of the confederates who erected the tower, and the chief instigator to that enterprise. But if the tower was built at the birth of Pheleg, according to the Hebrew computation, that chief was † either a child, or rather not born at that period (U). The Seventy have pronounced him a giant, as well as a huntsman. They have translated the Hebrew word *gebur*, which generally signifies *strong*, *mighty*, by the word γιγας, *giant;* an idea which we imagine those translators borrowed from the Greeks. The antediluvian giants are called *Nephelim* and *Rephaim*, but never *Geburim*. The Rabbinical writers, who justly hated the Babylonians, readily adopted this idea (X); and the fathers of the church, and the Byzantine historians, have universally followed them. He has been called *Nimrod*, *Nebrod*, *Nymbroth*, *Nebroth*, and *Nebris*. Not a few have made him the first *Bacchus*, and compounded his name of *Bar*, a son, and *Cush*, that is, the son of *Cush*. Some have imagined that he was the Orion of the Pagans, whose shade is so nobly described by Homer ‡. But the etymology of this last name implies something (Y) honourable, and very unsuitable to the idea of the *tyrant Nimrod*. It must be observed, however, that we find nothing in Scripture to warrant the supposition of his having been a tyrant; so far from it, that (Z) some have deemed him a benefactor to mankind. See NIMROD.

The beginning of this prince's kingdom was Babel. Eusebius gives us first * a catalogue of six kings of the Chaldæans, and then another of five kings of Arabian extraction, who reigned in Chaldæa after them. This might naturally enough happen, since it appears that the inhabitants of those parts of Arabia which are adjacent to Chaldea were actually Cushites, of the † same family with the Babylonians.

The Cushites, however, were at last subdued, perhaps partly expelled Chaldea by the *Chasidim*, who probably claimed that territory as the patrimony of their progenitors. That the Chasidim were neither *Cushites*, nor indeed *Hamites*, is obvious from the name. The Hebrews, and indeed all the Orientals ‡, denominated both the people who inhabited the eastern coast of Arabia *Cushim*, and also the Ethiopians who sprung from the last-mentioned people. Had the later inhabitants of Chaldea been the descendants of Cush, the Jewish writers would have called them *Cushim*. We find they called the Phœnicians *Chanaanim*, the Syrians *Aramim*, the Egyptians *Mizraim*, the Greeks *Jonim*, &c. The Chasidim, therefore, or modern inhabitants of Chaldea, were positively descended of one Chesed or Chased; but who this family-chief was, it is not easy to determine. The only person of that name whom we meet with in early times is the fourth son of Nahor §, the brother of Abraham; and some have been of opinion that the Chaldeans were the progeny of this same Chesed. This appears to us highly probable, because both Abram and Nahor were ‖ natives of *Ur* of the Chasidim. The former, we know, in consequence of the divine command, removed to *Haran*, afterwards *Charræ;* but the latter remained in *Ur*, where his family multiplied, and, in process of time, became masters of the country which they called the land of the Chasidim, from *Chesed* or *Chased*, the name of their ancestor. This account is the more probable, as we find the other branches of Nahor's family settled in the same neighbourhood (A).

16
Origin of the name Chaldæi.

How the Greeks came to denominate these people Χαλδαιοι, *Chaldæi*, is a question rather difficult to be resolved; but we know that they always affected to distinguish people and places by names derived from their own language. They knew a rugged, erratic nation (B) on

* Philip. lib. 18. cap. 3.

† Bochar. Phaleg. lib. 1. cap. 10.

‡ Odyss. l. 1. verse 571.

* Chron. lib i. page 14.

† Gen. x. Ezek. xxvii.

‡ Joseph. Ant. lib. i. cap. 6.

§ Gen. chap xxii. verse 22.

‖ Gen. chap. xi. verse 28.

(S) This war was probably carried on between the leaders of the Hamites and Ashur upon their invasion.

(T) Theoph. ad Antol. lib. ii. page 107. ed. Paris 1636.

(U) Gen, chap. x. verse 8, 9. "This man began to be a *giant* upon the earth: he was the giant hunter before the Lord God.—As Nymbrod the *giant* hunter before the Lord."

(X) See Mr Bryant's Analysis, vol. iii. page 38 et seq.

(Y) Orion is compounded of the Hebrew *Or*, "light," and *ion*, "one of the names of the sun;" and Orion was probably one of the names of that luminary.

(Z) See Shuckford's Connect. vol. i. lib. 3. page 179, 180. Also the authors of the Univer. Hist. vol. i.

(A) Huz gave name to the country of Job; Elihu, one of Job's friends, was a Buzite of the kindred of Ram or Aram, another of the sons of Nahor. Aram, whose posterity planted Syria cava, was the grandson of Nahor by Kemuel. Hence it appears probable that Job himself was a descendant of Nahor by Huz his first born.

(B) See Eustat. in Dion. Perieg. ver. 768. Strabo. lib. xii. page 543. Casaub. As the Chalybes were famous for manufacturing iron, so were they celebrated for making the choicest pieces of armour. They excelled in making

κλιβανοι,

on the banks of the river Thermodoon, in the territory of Pontus, bordering on Armenia the Less. These, in ancient times, were called *Alybes* or *Chalybes*, because they were much employed in forging and polishing iron. Their neighbours, at length, gave them the name of *Chald* or *Caled*, which imports, in the Armenian dialect, *fierce*, *hardy*, *robust*. This title the Greeks adopted, and out of it formed the word Χαλδαιοι, "Chaldeans."

The Mosaic history informs us (c), that Ashur went out of *that land* (Shinar, and built Nineveh and several other considerable cities. One of the successors of Ashur was the celebrated Ninus, who first broke the peace of the world †, made war upon his neighbours, and obliged them by force of arms to become his subjects, and pay tribute. Some authors make him the immediate successor of Ashur, and the builder of Nineveh. This we think is not probable; Eusebius as we have observed above, gives a list of six Arabian princes who reigned in Babylon. These we take to have been the immediate successors of Nimrod, called *Arabians;* because these people were Cushites. Ninus might be reputed the first king of the Assyrians, because he figured beyond his predecessors; and he might pass for the builder of Nineveh, because he greatly enlarged and beautified that city. We therefore imagine, that Ninus was the fifth or sixth in succession after Ashur.

Ninus, according to Diodorus Siculus ‡, made an alliance with Ariæus king of the Arabians, and conquered the Babylonians. This event, in our opinion, put an end to the empire of the Hamites or Cushim in Shinar or Babylonia. The author observes, that the Babylon which figured afterwards did not then exist. This fact is confirmed by the prophet Isaiah ‖: "Behold the land of the Chasidim; this people was not till Ashur founded it for them that dwell in the wilderness. They set up the towers thereof, &c." After Babylonia was subdued by the Assyrians under Ninus, the capital was either destroyed by that conqueror or deserted by the inhabitants. At length it was re-edified by some one or other of the Assyrian monarchs, who collected the roving Chasidim, and obliged them to settle in the new city. These were subject to the Assyrian empire till the reign of Sardanapalus, when both the Medes and Babylonians rebelled against that effeminate prince.

The Chasidim were celebrated by all antiquity for their proficiency in astronomy, astrology, magic, and curious sciences. Ur or Orchoe (D) was a kind of university for those branches of learning. Such was their reputation in those studies, that over a great part of Asia and Europe a Chaldean and an astrologer were synonymous terms. These sciences, according to the tradition of the Orientals, had been invented by Seth, whom they called *Edris;* and had been cultivated by his descendants downward to Noah, by whom they were transmitted to Shem, who conveyed them to Arphaxad and his posterity.

To us it appears probable, that the religious sentiments transmitted from Noah through the line of Shem, were kept alive in the family of Arphaxad, and so handed down to the families of Serug, Nahor, Terah, Abram, Nahor II. and Haran, &c. The Jewish rabbis, and all the Persian and Mahomedan writers, make Abraham contemporary with Nimrod; who, say they, persecuted him most cruelly for adhering to the true religion. That these two patriarchs were contemporary is very improbable, since Nimrod was the third generation after Noah, and Abram the tenth. Abram has been invested by the rabbinical writers with every department of learning. According to them, he transported from Charræ into Chanaan and Egypt, astronomy, astrology, mathematics, geography, magic, alphabetical writing, &c. &c.

17 Legendary tales concerning Abraham.

After the Babylonish captivity, when the Jews were dispersed over all the east, and began to make *proselytes of the gate* among the Pagans, wonderful things were reported of Abram with respect to his acquirements in human erudition, as well as his supereminence in virtue and piety. These legendary tales were believed by the proselytes, and by them retailed to their connections and acquaintances. But certainly the holy man either was not deeply versed in human sciences, or did not deem them of importance enough to be communicated to his posterity; since the Jews are, on all hands, acknowledged to have made little progress in these improvements. To think of raising the fame of Abraham, by classing him with the philosophers, betrays an extreme defect in judgment. He is entitled to praise of a higher kind; for he excelled in piety, was the father of the faithful, the root of the Messiah, and the friend of God. Before these, all other titles vanish away. Such of our readers, however, as have leisure enough, and at the same time learning enough to enable them to consult the rabbinical legends, will be furnished with a full and ample detail

† Justin, lib. i. cap. i.

‡ Lib. ii.

‖ Ch. xxiii. verse 13.

κλιβανοι, or coats of mail, or brigandines used by the bravest of the Persian horsemen. Bochart Phaleg. lib. iii. cap. 12. and 13. has proved that the word *Cheliba* signifies "scales of brass or steel." From the word *Cheliba*, the Greeks formed their Χαλυβες, *Chalybes*. Xenoph. Cyrop. lib. iii. p. 43. Steph. represents the Chaldeans, who inhabited a mountainous country bordering upon Armenia, as a very fierce warlike people. Ib. page 107. we have an example of their rapacious character. Id. ib. lib. iv. p. 192. Hen. Steph. we have an account of their bravery and of their arms. Another instance of their rapacity occurs in their plundering the cattle of Job.

(c) A dispute has arisen about the sense of verse 10. chap. x. Out of that land went forth Ashur, and builded Nineveh. Some approve our translation, which we think is just; others, considering that the inspired writer had been speaking of Nimrod and the beginning of his kingdom, are of opinion that it should be translated, And out of this land *He* (that is Nimrod) went into Ashur and builded Nineveh. This they make a military expedition, and a violent irruption into the territory of Ashur.

(D) Ur or Orchoe was situated between Nisibis and Corduena. See Ammianus Marcel. Expeditio Juliana, lib. xv. It lay not far from the river Tigris. Strabo, lib. xvi. p. 739, tells us that the Chaldean philosophers were divided into different sects, the Orcheni, the Borsippeni, and several others. Diod. Sicul. likewise, lib. ii. p. 82. Steph. gives an exact detail of the functions, profession, and establishment of the Chaldeans, to which we must refer our curious readers.

tail of his imaginary exploits and adventures. Others, who are either not willing or not qualified to peruse the writings of the rabbins, may consult Dr Hyde * de Relig. vet. Pers. and the authors of the Universal History †, where they will find materials sufficient to gratify their curiosity. We shall only observe, in addition to what we have already said, that the Persians, Chaldeans, and Arabians, pretended that their religion was that of Abraham; that honourable mention is made of him in the Koran; and that the name of Abraham or Ibrahim was celebrated over all the east. See ABRAHAM.

* Chap. ii.

† Vol I.

IN the progress of this disquisition, we have seen that the language of Noah was, in all probability, the same or nearly the same with that of Adam. Additions and improvements might be introduced, but still the radical stamina of the language remained unchanged. It has likewise, we hope, appeared, that the confusion of language at the building of the tower of Babel was only partial, and affected none but the rebellious crew of the race of Ham, and the apostate part of the families of Shem and Japhet. We have concluded, that the main body of the race of Shem, at least, were neither dispersed nor their language confounded; and that consequently the descendants of that patriarch continued to speak their paternal dialect or the uncorrupted language of Noah. To these arguments we may take the liberty to add another, which is, that in all probability the worship of the true God was preserved in the line of Arphaxad, after the generality of the other sects had lapsed into idolatry. Out of this family Abraham was taken, in whose line the true religion was to be preserved. Whether Abraham was an idolater when he dwelt in Chaldea, the Scripture does not inform us, though it seems to be evident that his father was. One thing, however, is certain, namely, that Jehovah (E) appeared to him, and pronounced a blessing upon him before he left Ur of the Chaldees. This circumstance no doubt indicates, that this patriarch had made uncommon advances in piety and virtue, even prior to his emigration. The progenitors of his family had been distinguished by adhering to the true religion. About this time, however, they began to degenerate, and to adopt the Zabiism of their apostate neighbours. It was then that Abraham was commanded by Heaven to "leave his kindred and his father's house, and to travel into a land which was to be shown him." The Almighty intended that the true religion should be preserved in his line, and therefore removed him from a country and kindred, by the influence of whose bad example his religious principles might be endangered. His family had only of late apostatized; till that period they had preserved both the language and religion of their venerable ancestors.

18 The Hebrew and Chaldean originally the same, and the first language spoken on earth.

But however much Abraham might differ from the other branches of his family in his religious sentiments, his language was certainly in unison with theirs. The consequence of this unquestionable position is, that the language which he carried with him into Chanaan was exactly the same with that of his family which he relinquished when he began his peregrinations. But if this be true, it will follow, that the language afterwards denominated Hebrew, and that of the Chasidim or Chaldeans, were originally one and the same. This position, we think, will not be controverted. There is then an end of the dispute concerning the original language of mankind. We have advanced some presumptive proofs in the preceding pages, that the language of Adam was transmitted to Noah, and that the dialect of the latter was preserved in the line of Arphaxad downwards to the family of Abraham: and it now appears that the Hebrew and Chaldean were originally spoken by the same family, and of course were the same between themselves, and were actually the first language upon earth, according to the Mosaic history. Numberless additions, alterations, improvements, we acknowledge, were introduced in the course of 2000 years; but still the original stamina of the language were unchanged. Our readers will please to observe that the Orientals are not a people *given to change;* and that this character, in the earliest ages, was still more prevalent than at present. This assertion, we presume, needs no proof.

In confirmation of these presumptive arguments, we may add the popular one which is commonly urged upon this occasion, viz. that the names of antediluvian persons and places mentioned by the sacred historian, are generally of Hebrew original, and significant in that language. Some of them, we acknowledge, are not so; but in this case it ought to be remembered, that a very small part of that language now exists, and that probably the radicals from which these words are descended are among the number of those which have long been lost.

SECT. I. *The Hebrew Language.*

19 Characteristics of the Hebrew language.

HAVING thus proved the priority of the Hebrew to every other language that has been spoken by men, we shall now proceed to consider its nature and genius; from which it will appear still more evidently to be an original language, neither improved nor debased by foreign idioms. The words of which it is composed are short, and admit of very little flexion. The names of places are descriptive of their nature, situation, accidental circumstances, &c. Its compounds are few, and inartificially joined together. In it we find few of those artificial affixes which distinguish the other cognate dialects; such as the Chaldean, Syrian, Arabian, Phœnician, &c. We find in it no traces of improvement from the age of Moses to the era of the Babylonish captivity. The age of David and Solomon was the golden period of the Hebrew tongue; and yet, in our opinion, it would puzzle a critic of the nicest acumen to discover much improvement even during that happy era. In fact, the Jews were by no means an inventive people. We hear nothing of their progress in literary pursuits; nor do they seem to have been industrious in borrowing from their neighbours. The laws and statutes communicated by Moses were the principal objects of their studies. These they were commanded to contemplate day and night; and in them they were to place their chief delight. The consequence of this command was, that little or no regard could be paid to taste, or any other subject

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(E) Compare Gen. chap. xii. ver. 2. with Acts, chap. vii. ver. 4.

subject of philosophical investigation. Every unimproved language abounds in figurative expressions borrowed from sensible objects. This is in a peculiar manner the characteristic of the language in question; of which it would be superfluous to produce instances, as the fact must be obvious even to the attentive reader of the English Bible.

In the course of this argument, we think it ought to be observed, and we deem it an observation of the greatest importance, that if we compare the other languages which have claimed the prize of originality from the Hebrew with that dialect, we shall quickly be convinced that the latter has a just title to the preference. The writers who have treated this subject, generally bring into competition the Hebrew, Chaldean, Syrian, and Arabian. Some one or other of these has commonly been thought the original language of mankind. The arguments for the Syrian and Arabian are altogether futile. The numerous improvements superinduced upon these languages, evidently prove that they could not have been the original language. In all cognate dialects, etymologists hold it as a maxim, that the least improved is likely to be the most ancient.

We have observed above, that the language of Abraham and that of the Chesedim or Chaldeans were originally the same; and we are persuaded, that if an able critic should take the pains to examine strictly these two languages, and to take from each what may reasonably be supposed to have been improvements or additions since the age of Abraham, he will find intrinsic evidence sufficient to convince him of the truth of this position. There appear still in the Chaldean tongue great numbers of (F) words the same with the Hebrew, perhaps as many as mankind had occasion for in the most early ages; and much greater numbers would probably be found if both languages had come down to us entire. The construction of the two languages is indeed somewhat different; but this difference arises chiefly from the superior improvement of the Chaldean. While the Hebrew language was in a manner stationary, the Chaldean underwent progressive improvements; was mellowed by antitheses, rendered sonorous by the disposition of vocal sounds, acquired a copiousness by compounds, and a majesty by affixes and prefixes, &c. In process of time, however, the difference became so great, that the Israelites did not understand the Chaldean language at the era of the Babylonish captivity. This much the prophet * intimates, when he promises the pious Jews protection "from a fierce people; a people of a deeper speech than they could perceive; of a stammering tongue, that they could not understand."

20
How it was changed into what is called the Chaldean.

The priority of the Chaldean tongue is indeed contended for by very learned writers. Camden † calls it the mother of all languages; and most of the fathers were of the same opinion. Amira ‡ has made a collection of arguments, not inconsiderable, in favour of it; and Myriceus § after him, did the same. Erpenius ||, in his Oration for the Hebrew tongue, thought the argument for it and the Chaldean so equal, that he did not choose to take upon him to determine the question.

Many circumstances, however, concur to make us assign the priority to the Hebrew, or rather to make us believe that it has suffered fewest of those changes to which every living tongue is more or less liable. If we strip this language of every thing obviously adventitious, we shall find it extremely simple and primitive. 1. Every thing masoretical, supposing the vowels and points (G) essential, was certainly unknown in its original character. 2. All the prefixed and affixed letters were added time after time, to give more compass and precision to the language. 3. The various voices, moods, tenses, numbers, and persons of verbs, were posterior improvements; for in that tongue, nothing at first appeared but the indeclinable radix. 4. In the same manner, the few adjectives that occur in the language, and the numbers and regimen of nouns, were not from the beginning. 5. Most of the Hebrew nouns are derived from verbs; indeed many of them are written with the very same letters. This rule, however, is not general; for often verbs are derived from nouns, and even some from prepositions. 6. All the verbs of that language, at least all that originally belonged to it, uniformly consist of three letters, and seem to have been at first pronounced as monosyllables. If we anatomize the Hebrew language in this manner, we shall reduce it to very great simplicity; we shall confine it to a few names of things, persons, and actions; we shall make all its words monosyllables, and give it the true characters of an original language. If at the same time we reflect on the small number of (H) radical words in that dialect, we shall be more and more convinced of its originality.

21
Reasons for maintaining the priority of the Hebrew.

It will not be expected that we should enter into a minute discussion of the grammatical peculiarities of this ancient language. For these we must refer our readers to the numerous and elaborate grammars of that tongue, which are everywhere easily to be found. We shall only make a few strictures, which naturally present themselves, before we dismiss the subject.

The generality of writers who have maintained the superior antiquity of the Hebrew language, have at the same time contended that all other languages of Asia, and most of those of Europe, have been derived from that tongue as their source and matrix. We, for our part, are of opinion, that perhaps all the languages in the eastern part of the globe were coeval with it, and were originally one and the same; and that the differences which afterwards distinguished them sprung from climate, caprice, inventions, religions, commerce, conquests,

22
All languages in the east originally the same.

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* Isaiah, ch. xxxiii. verse 19.

† Brit.

‡ Præf. ad Gram. Syr.

§ Præf. ad Gram. Chald.

|| Oratio de lingua Hebr. xii.

(F) Most of the Chaldean names mentioned in Scripture are pure Hebrew words compounded; such as *Nebuchadnezzar*, *Nebuzaradan*, *Rabshakeh*, *Rabmag*, *Belshazzar*, *Rabsaris*, *Nahar*, *Malahtha*, *Phrat* or *Pharad*, *Barosus*, *Carchemish*, *Ur*, *Cutha*, Heb. *Cush*, &c. All these words, and a multitude of others which we could mention, approach so near the Hebrew dialect, that their original is discernible at first sight. Most of these are compounds, which the limits prescribed us will not allow us to decompound and explain.

(G) The futility of these points will be proved in the following part of this section.

(H) The radical words in the Hebrew language, as it now stands, are about 500.

quests, and other accidental causes, which will occur to our intelligent readers. We have endeavoured to prove, in the preceding pages, that all mankind were not concerned in the building of the fatal tower, nor affected by the punishment consequent upon that attempt: and we now add, that even that punishment was only temporary; since we find, that those very Hamites or Cushim, who are allowed to have been affected by it, did certainly afterwards recover the former organization of their *lip*, and differed not more from the original standard than the descendants of Japhet and Shem.

The Jewish rabbis have pretended to ascertain the number of languages generated by the vengeance of Heaven at the building of Babel. They tell us that mankind was divided into 70 nations and 70 languages, and that each of these nations had its tutelar or guardian angel. This fabulous legend is founded on the number of the progeny of Jacob at the time when that patriarch and his family went down into Egypt. Others attribute its origin to the number of the sons and grandsons of Noah, who are enumerated Gen. chap. x.

The fathers * of the church make the languages at the confusion to amount to 72; which number they complete by adding Cainan and Elishah, according to the Septuagint, who are not mentioned in the Hebrew text. This opinion, they think, is supported by the words of Moses, when he saith, that † "when the Most High divided to the nations their inheritance, when he separated the sons of Adam, he set the bounds of the people according to the number of the tribes of Israel." That is, say they, he divided them into 72 nations, which was the number of the children of Israel when they came into Egypt. The Targum of Ben-Uzziel plainly favours this interpretation; but the Jerusalem Targum intimates that the number of nations was only 12, according to the number of the tribes of Israel. This passage, however, seems to refer to the tribes of the Chanaanim; and imports, that the Almighty assigned to the different septs of that family such a tract of land as he knew would make a sufficient inheritance for the children of Israel ‡. Others have increased the different languages of the dispersion to 120; but the general opinion has fixed them to 70 or 72. Our readers need scarce be put in mind that these opinions are futile and absurd; neither founded in Scripture, profane history, or common sense. At the same time, it must not be omitted, that according to Horapollo §, the Egyptians held, that the world was divided into 72 habitable regions; and that, in consequence of this tradition, they made the cynocephalus the emblem of the world, because that in the space of 72 days that animal pines away and dies.

* *Clem. Alex. Strom. Euseb. Chron.* lib. i. *Epiphan. Hæres. August.* &c.

† Deut. chap. xxxii. verse 8.

‡ *Pacanini Episcop. Bercun. apud Hier. on in Catalogo Epist.* 22.

§ 14 page 25 *Hoesch.*

23
Origin of the name *Hebrew.*

It has been made a question, whether the Hebrew language was denominated from Heber the progenitor of Abraham, or from a word which in that tongue imports *over*, *beyond*. Most of the Christian fathers, prior to St Origen, believed that both the Gentile name *Hebrew*, and the name of the language, were derived from the name of the patriarch; but that learned man imagined, that Abraham was called the *Hebrew*, not because he was a descendant of Heber, but because he was a transfluvianus, or from beyond the river Euphrates. The learned Bochart * has strained hard to prove the former position; but to us his arguments do not appear decisive. We are rather inclined to believe, that Abraham was called *Chibri*, (Hebrew), from the situation of the country from which he emigrated when he came to the country of Chanaan; and that in process of time that word became a Gentile appellation, and was afterwards applied to his posterity (1) often by way of reproach, much in the same manner as we say a *Northlander*, a *Norman*, a *Tramontane*, &c.

* *Phaleg.* lib. i. c. 15.

Here we may be indulged an observation, namely, that Abraham, a Hebrew, lived among the Chaldeans, travelled among the Chanaanites, sojourned among the Philistines, lived some time in Egypt, and in all appearance conversed with all those nations without any apparent difficulty. This circumstance plainly proves, that all these nations at that time spoke nearly the same language. The nations had not yet begun to improve their respective dialects, nor to deviate in any great measure from the monosyllablic tongue of the Hebrews. With respect to the language of Chanaan, afterwards the Phœnician, its similarity to the Hebrew is obvious from the names of gods, men, cities, mountains, rivers, &c. which are the very same in both tongues, as might be shown in numberless cases, were this a proper place for etymological researches.

Before we dismiss this part of our subject, we would wish to gratify our unlearned readers with a brief account of the Hebrew letters, and of the Masoretical points which have in a manner been ingrafted on these letters. In the course of this deduction, we shall endeavour to follow such authors as are allowed to have handled that matter with the greatest acuteness, learning, and perspicuity. If upon any occasion, we should be tempted to hazard a conjecture of our own, it is cheerfully submitted to the candour of the public.

24
Origin of alphabetic writing.

Much has been written, and numberless hypotheses proposed, with a view to investigate the origin of *alphabetical writing*. To give even an abridged account of all these, would fill many volumes. The most plausible, in our opinion, is that which supposes that the primary characters employed by men were the figures of material objects, analogous to those of the Mexicans, so often mentioned by the authors who have written the history of that people at the era of the Spanish invasion of their country. As this plan was too much circumscribed to be generally useful, hieroglyphical figures were in process of time invented as subsidiaries to this contracted orthography. In this scheme, we imagine, the process was somewhat more extensive. A *lion* might be sketched, to import fierceness or valour; an *ox*, to denote strength; a *stag*, to signify swiftness; a *hare*, to intimate timorousness, &c.

The next step in this process would naturally extend to the inventing and appropriating of a few arbitrary characters, for representing abstract ideas, and other relations, which could not be well ascertained by the methods above mentioned. These arbitrary signs might readily acquire a currency by compact, as money and medals do over a great part of the world.—Upon this plan we imagine the ancient Chinese formed their language.

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(1) The Egyptians might not eat bread with the Hebrews, for that is an abomination to the Egyptians. The Philistines (Samuel I. *pass.*) always call the Israelites *Hebrews* by way of reproach.

But neither the picture nor the hieroglyphic, nor the method of denoting *ideas* by arbitrary characters appropriated by compact, could ever have arrived at such perfection as to answer all the purposes of ideal communication. The grand desideratum then would be to fabricate characters to represent simple sounds, and to reduce these characters to so small a number as to be easily learned and preserved in the memory. In this attempt the Chinese have notoriously failed; their letters, or rather their characters, are so numerous, that few, if any, of their most learned and industrious authors, have been able to learn and retain the whole catalogue. Indeed those people are not able to conceive how any combinations of 20 or 30 characters should be competent to answers all the purposes of written language.

Many different nations have claimed the honour of this invention. The Greeks ascribed it to the Phœnicians; and consequently used the word φοινικιζειν *, *to act the Phœnician*, in the same sense with αναγινωσκειν, *to read;* and consequently the poet † ascribes the invention to the same ingenious people. The Greeks borrowed their letters from the Phœnicians, and of course looked up to them as the inventors.

* *Hesych.*

† *Lucan.*

Others have attributed the invention to the Egyptians. That people ascribed every useful and ingenious invention to their Thyoth, or Mercury Trismegistus. Plato seems to have believed this tradition (K), and pretends to record a dispute between the king of Egypt that then reigned and this personage, with respect to the influence that the art of alphabetic writing might possibly have upon the improvements of mankind in science and liberal arts. Diodorus the Sicilian ‡ gives a similar history of the same invention, but carries it back to the reign of Osiris.

‡ *Bibl.* lib. i. page 10. Steph.

Pliny informs us §, that Gellius attributed letters to the same Egyptian Mercury, and others to the Syrians; but that for "his part, he thought that the Assyrian letters were eternal." That learned Roman then imagined, that the Assyrian letters had existed at a period prior to all the records of history; which was in fact the case. By the Assyrian letters, he must mean the Chaldaic, and by the Syrian probably the Hebrew. The earliest Greek historians generally confound the Jews with the Syrians. Herodotus, enumerating the people who had ‖ learned circumcision from the Egyptians, mentions the Syrians of Palestine; and elsewhere he tells us, that Necho * beat the Syrians, and took Cadytis, a large and populous city belonging to that people. Hence it is evident that the Syrian alphabet, or the Syrian letters, were the same with the Hebrew. That the Assyrian or Chaldaic and Hebrew languages were the same, has, we hope, been fully proved already: that their letters were the same in the original structure, can scarce be controverted. These letters, we think, were antediluvian; whether, to use the expression of Plato, they were dictated by some god, or fabricated by some man divinely inspired. As this opinion may admit some dispute, we shall take the liberty to subjoin our reasons.

§ *Nat. Hist.* lib. vii. c. 46.

‖ Lib ii. c. 104.

* Ibid. c. 159.

25 Antediluvian.

1. It appears that the era of this invention is buried in impenetrable obscurity. Had an invention of such capital importance to mankind been made in the postdiluvian ages, we imagine the author would have been commemorated in the historical annals of the country where he lived (L).

2. The art of writing in alphabetical characters, according to the sacred records, was practised at so early a period, that there was not a long enough interval between that and the deluge to give birth to that noble invention. If we consider the state of the world during some ages after that disastrous event, we shall quickly be convinced that little respite could be found from the labour and industry indispensably requisite to provide the necessaries, and only a few of the conveniences, of life. Such a state of things was certainly most unfavourable to the invention of those arts and improvements which contribute nothing towards procuring the accommodations of life. The consequence is obvious.

Moses has recorded the history of the creation, of a few of the capital transactions of the antediluvian world, the birth, the age, the death, of the lineal descendants of Seth. He has preserved the dimensions of the ark, the duration of the universal deluge, its effects upon man and all terrestrial animals, the population of the world by the posterity of Noah, the age, &c. of the patriarchs of the line of Shem, from which his own ancestors had sprung. To this he has subjoined the petty occurrences which diversified the lives of Abraham, Isaac, and Jacob, and their descendants. Whence did the historian derive his information? We believe few of our readers will be so enthusiastic as to imagine that the author received it from divine inspiration. Tradition is a fallible guide; and in many cases the accounts are so minutely precise, as to defy the power of that species of conveyance. The inspired author most certainly have extracted his abridgement from written memoirs, or histories of the transactions of his ancestors regularly transmitted from the most early periods. These annals he probably abridged, as Ezra did afterwards the history of the kings of Israel. If this was the case, as it most certainly was, the art of writing in alphabetical letters must have been known and practised many ages before Moses. It has indeed been pretended, that the Jewish decalogue, inscribed upon two tables of stone, was the very first specimen of alphabetical writing. The arguments adduced in proof of this fact are lame and inconclusive

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(K) See *Phædrus*, page 1240. See also page 374. *Phil.*

(L) It is true, the Egyptians attribute the invention to their Thoth, and the Phœnicians to their Hercules, or Melicerta or Baal; but these were only imaginary personages.

Hebrew Language.

clusive (M). Had that been the case, some notice must have been taken of so palpable a circumstance. Moses wrote out his history, his laws, and his memoirs; and it appears plainly from the text, that all the learned among his countrymen could read them. Writing was then no novel invention in the age of the Jewish legislator, but current and generally known at that era.

Hebrew Language.

The patriarch Job lived at an earlier period. In that book we find many allusions to the art of writing, and

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(M) The most ingenious and plausible of those arguments which have fallen under our observation, is given by Mr Johnson vicar of Cranbrook, a writer of great learning and piety, who flourished in the beginning of the 18th century, and whose works deserve to be more generally known than we have reason to think they are at present. After endeavouring to prove that alphabetical writing was not practised before the era of Moses, and expatiating upon the difficulty of the invention, this excellent scholar attempts to show, that the original Hebrew alphabet was actually communicated to the Jewish legislator at the same time with the two tables of the law. "I know not (says he) any just cause why the law should be *written by God*, or by an *angel* at his command, except it were for want of a man that could well perform this part. This could give no addition of authority to the law, especially after it had been published in that astonishing and miraculous manner at Mount Sinai. The true writing of the original was indeed perfectly adjusted, and precisely ascertained to all future ages, by God's giving a copy of it under his own hand; but this, I conceive, had been done altogether as effectually by God's dictating every word to Moses, had he been capable of performing the office of an amanuensis." The learned writer goes on to suppose, that it was for the purpose of *teaching Moses the alphabet*, that God detained him forty days in the mount; and thence he concludes, that the Decalogue was the first writing in alphabetical characters, and that those characters were a divine, and not a human invention.

It is always rash, if not something worse, to conceive reasons not assigned by God himself, for any particular transaction of his with those men whom he from time to time inspired with heavenly wisdom. That is was *not* for the purpose of teaching Moses the alphabet that God detained him forty days in the mount, when he gave him the two tables of the law, seems evident from his detaining him just as many days when he gave him the second tables after the first were broken. If the legislator of the Jews had not been sufficiently instructed in the art of reading during his first stay in the mount, he would have been detained longer; and it is not conceivable, that though in a fit of pious passion he was so far thrown off his guard as to break the two tables, his mind was so totally unhinged by the idolatry of his countrymen, as to forget completely an art which, by the supposition, the Supreme Being had spent *forty days* in teaching him! "But if Moses could, at his first ascent into the mount, perform the office of an amanuensis, why are the original tables said to have been written by the finger of God, and not by him who wrote the second?" We pretend not to say why they were written by God rather than man; but we think there is sufficient evidence, that by whomsoever they were written, the characters employed were of human invention. The Hebrew alphabet, without the Masoretic points, is confessedly defective; and every man who is in any degree acquainted with the language, and is not under the influence of inveterate prejudice, will readily admit that those points are no improvement. But we cannot, without impiety, suppose an art invented by infinite wisdom, to fall short of the utmost perfection of which it is capable: an alphabet communicated to man by God, would undoubtedly have been free both from defects and from redundancies; it would have had a distinct character for every simple sound, and been at least as perfect as the Greek or the Roman.

But we need not fill our pages with reasonings of this kind against the hypothesis maintained by Mr Johnson. We know that "Moses wrote all the words of the Lord," i. e. the substance of all that had been delivered in *Exod.* xx, xxi, xxii, xxiii. before he was called up into the mount to receive the tables of stone; nay, that he had long before been commanded by God himself to "write in a book" an account of the victory obtained over Amalek (*Exod.* xvii. 14.). All this, indeed, the learned writer was aware of; and to reconcile it with his hypothesis, he frames another, more improbable than even that which it is meant to support. "It is not unreasonable (says he) to believe that God had written these tables of stone, and put them in Mount Horeb, from the time that by his angel he had there first appeared to Moses; and that, therefore, all the time after, while he kept Jethro's sheep thereabouts, he had free access to those tables, and perused them at discretion. But if belief should rest upon evidence, we beg leave to reply, that to believe all this would be in the highest degree unreasonable; for there is not a single hint in the Scripture of the tables having been written at so early a period, or upon such an occasion, as God's first appearance to Moses in the burning bush. We know how reluctant Moses was to go upon the embassy to which he was then appointed; and it is strange, we think passing strange, that when he records so faithfully his own backwardness, and the means made use of by God to reconcile him to the arduous undertaking, he should make no mention of these important tables, if at that period he had known any thing of their existence. Besides all this, is it not wonderful, if Moses had been practising the art of writing, as our author supposes, from the time of the burning bush to the giving of the law, he should then have stood in need of *forty days* teaching from God, to enable him to *read* with ease the first tables; and of other forty, to enable him to *write* the second? This gives such a mean view of the natural capacity of the Hebrew legislator, as renders the hypothesis which implies it wholly incredible. See a *Collection of Discourses*, &c. *in two volumes, by the reverend John Johnson*, A. M. *vicar of Cranbrook in Kent.*

and some passages which plainly prove its existence. This shows that alphabetical characters were not confined to the chosen seed, since Job was in all probability a descendant of Huz, the eldest son of Nahor * the brother of Abraham. From this circumstance, we think we may fairly conclude, that this art was known and practised in the family of Terah the father of Abraham.

* Gen xxii. 20, &c.

† Antiq. lib. i. c. 3.

26 Traditions to this purpose.

3. There was certainly a tradition among the Jews in the age of Josephus, that writing was an antediluvian invention †. That historian pretends, that the descendants of Seth erected two pillars, the one of stone and the other of brick, and inscribed upon them their astronomical observations and other improvements.—This legend shows that there did exist such an opinion of the antiquity of the art of writing.

4. There must have been a tradition to the same purpose among the Chaldeans, since the writers who have copied from Berosus, the celebrated Chaldean historian (O), speak of alphabetical writing as an art well known among the antediluvians. According to them, Oannes the Chaldean legislator gave his disciples " an insight into *letters* and science. This person also *wrote* concerning the generation of mankind, of their different pursuits, of civil polity, &c. Immediately before the deluge (say they) the god Cronus appeared to Sisuthrus or Xisuthrus, and commanded him to commit to *writing* the beginning, improvement, and conclusion of all things down to the present term, and to bury these accounts securely in the temple of the Sun at Seppara." All these traditions may be deemed fabulous in the main; but still they evince that such an opinion was current, and that though the use of letters was not indeed eternal (P), it was, however, prior to all the records of history; and of course, we think, an antediluvian discovery.

27 The original alphabet preserved in the family of Noah.

This original alphabet, whatever it was, and however constructed, was, we think, preserved in the family of Noah, and from it conveyed down to succeeding generations. If we can then discover the original Hebrew alphabet, we shall be able to investigate the primary species of letters expressive of those articulate sounds by which man is in a great measure distinguished from the brute creation. Whatever might be the nature of that alphabet, we may be convinced that the ancient Jews deemed it sacred, and therefore preserved it pure and unmixed till the Babylonish captivity. If, then, any monuments are still extant inscribed with letters prior to that event, we may rest assured that these are the remains of the original alphabet.

There have, from time to time, been dug up at Jerusalem, and other parts of Judea, coins and medals, and medallions, inscribed with letters of a form very different from those square letters in which the Hebrew Scriptures are now written.

28 The same with the Samaritan.

† Mem. de l'Academ. de l'Inscrip. &c.

When the Samaritan Pentateuch was discovered (Q), it evidently appeared that the inscriptions on those medals and coins were drawn in genuine Samaritan characters. The learned abbé Barthelemi, in his * dissertation " on the two medals of Antigonus king of Judea, one of the later Asmonean princes, proves that all the inscriptions on the coins and medals of Jonathan and Simon Maccabeus, and also on his, were invariably in the Samaritan character, down to the 40th year before the Christian era."

29 Which afterwards gave place to the Chaldaic.

It were easy to prove, from the Mishna and Jerusalem Talmud, that the Scriptures publicly read in the synagogues to the end of the second century were written in the Samaritan character, we mean in the same character with the Pentateuch in question. As the ancient Hebrew, however, ceased to be the vulgar language of the Jews after the return from the Babylonish captivity, the copies of the Bible, especially in private hands, were accompanied with a Chaldaic paraphrase; and at length the original Hebrew character fell into disuse, and the Chaldaic was universally adopted.

It now appears that the letters inscribed on the ancient coins and medals of the Jews were written in the Samaritan form, and that the Scriptures were written in the very same characters: we shall therefore leave it to our readers to judge whether (considering the implacable hatred which subsisted between these two nations) it be likely that the one copied from the other; or at least that the Jews preferred to the beautiful letters used by their ancestors, the rude and inelegant characters of their most detested rivals. If, then, the inscriptions on the coins and medals were actually in the characters of the Samaritan Pentateuch (and it is absurd to suppose that the Jews borrowed them from the Samaritans), the consequence plainly is, that the letters of the inscriptions were those of the original Hebrew alphabet, coeval with that language, which we dare to maintain was the first upon earth.

It may, perhaps, be thought rather superfluous to mention, that the Samaritan colonists, whom the kings of Assyria planted in the cities of Samaria (R), were natives of countries where Chaldaic letters were current, and who were probably ignorant of the Hebrew language and characters. When those colonists embraced the Jewish religion, they procured a copy of the Hebrew Pentateuch written in its native character, which, from superstition, they preserved inviolate as they received

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(O) Apollodorus, Alexander Polyhistor, Abydenus. See *Syncellus*, cap. 39. *et seq. Euseb. Chron.* lib. i. page 3.

(P) Plin. Nat. Hist. lib. vii. page 413.——*Ex quo apparet æternus literarum usus.*

(Q) The celebrated Archbishop Usher was the first who brought the Samaritan Pentateuch into Europe. In a letter to Ludovicus Capellus " he acknowledges, that the frequent mention he had seen made of it by some authors, would not suffer him to be at rest till he had procured five or six copies of it from Palestine and Syria."

(R) 2 Kings, chap. xvii. ver. 24. " And the king of Assyria brought men from Babylon, and from Cuthah, and from Avah, and from Hamath, and from Sepharvaim, and placed them in the cities of Samaria." Babylon and Cuthah, and Avah, were neighbouring cities, and undoubtedly both spoke and wrote in the Chaldaic style. The natives of Hamath spoke the Syriac, which at that time differed very little from the Chaldaic.

ceived it; and from it were copied successively the others which were current in Syria and Palestine when Archbishop Usher procured his.

From the reasons above exhibited, we hope it will appear, that if the Hebrew alphabet, as it appears in the Samaritan Pentateuch, was not the primitive one, it was at least that in which the Holy Scriptures were first committed to writing.

30 Which was introduced by Ezra.

Scaliger has inferred, from a passage in Eusebius*, and another in St Jerome†, that Ezra, when he reformed the Jewish church, transcribed the Scriptures from the ancient characters of the Hebrews into the square letters of the Chaldeans. This, he thinks, was done for the use of those Jews who, being born during the captivity, knew no other alphabet than that of the people among whom they were educated.—This account of the matter, though probable in itself, and supported by passages from both Talmuds, has been attacked by Buxtorf with great learning and no less acrimony. Scaliger, however, has been followed by a crowd of learned men (s), whose opinion is now pretty generally espoused by the sacred critics.

* *Chron. in anno* 4740.
† *Præf.* 1. *Reg.*

Having said so much concerning the Hebrew alphabet in the preceding pages, we find ourselves laid under a kind of necessity of hazarding a few strictures on the vowels and Masoretic points; the *first* essential, and the *last* an appendage, of that ancient language. The number of the one, and the nature, antiquity, and necessity of the other, in order to read the language with propriety and with discrimination, have been the subject of much and often illiberal controversy among philological writers. To enter into a minute detail of the arguments on either side, would require a complete volume: we shall, therefore, briefly exhibit the state of the controversy, and then adduce a few observations, which, in our opinion, ought to determine the question.

31 The Hebrew vowels.

The controversy then is, Whether the Hebrews used any vowels; or whether the points, which are now called by that name, were substituted instead of them? or if they were, whether they be as old as Moses, or were invented by Ezra, or by the Masorites (t)? This controversy has exercised the wits of the most learned critics of the two last centuries, and is still far enough from being determined in the present. The Jews maintain, that these vowel points (u) were delivered to Moses along with the tables of the law; and consequently hold them as sacred as they do the letters themselves. Many Christian authors who have handled this subject, though they do not affirm their divine original, nor their extravagant antiquity, pretend, however, that they are the only proper vowels in the language, and regulate and ascertain its true pronunciation. Though they differ from the Jews with respect to the origin of these points, they yet allow them a pretty high antiquity, ascribing them to Ezra and the members of the great synagogue.

32 The Masoretic points a modern invention.

At length, however, about the middle of the 16th century, Elias Levita, a learned German Jew who then flourished at Rome, discovered the delusion, and made it appear that these appendages had never been in use till after the writing of the Talmuds, about 500 years after Christ. This innovation raised Elias a multitude of adversaries, both of his own countrymen and Christians. Among the latter appeared the two Buxtorfs, the father and the son, who produced some cabbalistical books of great antiquity (x), at least in the opinion of the Jews, in which there was express mention of the points. The Buxtorfs were answered by Capellus and other critics*, till Father Morinus†, having examined all that had been urged on both sides, produced his learned dissertation on that subject; against which there has been nothing replied of any consequence, whilst his work has been universally admired, and his opinion confirmed by those that have beaten the same field after him.

* Walton, Dupin, and Vossius.
† *Dissert. Bibl.*

According to this learned father, it plainly appears that neither Origen, nor St Jerome, nor even the compilers of the Talmuds, knew any thing of what has been called the vowel points; and yet these books, according to the same author, were not finished till the seventh century. Even the Jewish rabbis who wrote during the eighth and ninth centuries, according to him, were not in the least acquainted with these points. He adds, that the first vestiges he could trace of them were in the writings of Rabbi Ben Aber chief of the western, and of Rabbi Ben Naphtali chief of the eastern school, that is, about the middle of the tenth century; so that they can hardly be said to be older than the beginning of that period.

Some learned men (y) have ascribed the invention of the vowel points in question to the rabbis of the school of Tiberias; which, according to them, flourished about the middle of the second century. This opinion is by no means probable, because it appears plain from history, that before that period all the Jewish seminaries in that province were destroyed, and their heads forced into exile. Some of these retired into Babylonia, and settled at Sora, Naberds, and Pombeditha, where they established famous universities. After this era, there remained no more any rabbinical schools in Judæa, headed by professors capable of undertaking this difficult operation, nor indeed of sufficient authority to recommend it to general practice, had they been ever so thoroughly qualified for executing it.

Capellus and Father Morin, who contend for the late introduction of the vowel-points, acknowledge that

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(s) Casaubon, Grotius, Vossius, Bochart, Morin, Brerewood, Walton, Prideaux, Huet, and Lewis Capel, always a sworn enemy to Buxtorf. All these have maintained the same ground with Scaliger: how truly, appears above.

(t) The term *masorah* or *massoreth* signifies "tradition;" and imports the unwritten canon by which the reading and writing of the sacred books was fixed.

(u) These points are 14 in number, whose figures, names, and effects, may be seen in most Hebrew grammars.

(x) These books are the *Bahir*, *Zahar*, and the *Kisri*. As for the Kizri, the Jews make it about 1900 years old; and the other about a century later. But the fidelity of the Jews in such matters cannot be relied upon.

(y) See Buxtorf the father, in Tiber. cap. 5, 6, 7. Buxtorf the son, de Antiq. Punct. P. II. 11.

33 *The matres lectionis.*

that there can certainly be no language without vocal sounds, which are indeed the soul and essence of speech; but they affirm that the Hebrew alphabet actually contains vowel characters, as well as the Greek and Latin and the alphabets of modern Europe. These are *aleph, he, vau, jod.* These they call the *matres lectionis*, or, if you please, the parents of reading. To these some, we think very properly, add *ain* or *oin, ajin.* These, they conclude, perform exactly the same office in Hebrew that their descendants do in Greek. It is indeed agreed upon all hands, that the Greek alphabet is derived from the Phœnician, which is known to be the same with the Samaritan or Hebrew. This position we shall prove more fully when we come to trace the origin of the Greek tongue. Hitherto the analogy is not only plausible, but the resemblance precise. The Hebrews and Samaritans employed these vowels exactly in the same manner with the Greeks; and so all was easy and natural.

34 **Objections answered.**

But the assertors of the Masoretic system maintain that the letters mentioned above are not vowels but consonants or aspirations, or any thing you please but vocal letters. This they endeavour to prove from their use among the Arabians, Persians, and other oriental nations: But to us it appears abundantly strange to suppose that the Greeks pronounced *beta, gamma, delta,* &c. exactly as the Hebrews and the Phœnicians did, and yet at the same time did not adopt their mode of pronunciation with respect to the five letters under consideration. To this argument we think every objection must undoubtedly yield. The Greeks borrowed their letters from the Phœnicians; these letters were the Hebrew or Samaritan. The Greeks wrote and (z) pronounced all the other letters of their alphabet, except the five in question, in the same manner with their originals of the east: if they did so, it obviously follows that the Greek and oriental office of these letters was the same.

Another objection to reading the Hebrew without the aid of the Masoretic vowel points, arises from the consideration, that without these there will be a great number of radical Hebrew words, both nouns and verbs, without any vowel intervening amongst the consonants, which is certainly absurd. Notwithstanding this supposed absurdity, it is a well known fact, that all the copies of the Hebrew Scripture, used in the Jewish synagogues throughout the world, are written or printed without points. These copies are deemed sacred, and kept in a coffer with the greatest care, in allusion to the ark of the testimony in the tabernacle and temple. The prefect, however, reads the portions of the law and hagiographa without any difficulty. The same is done by the remains of the Samaritans at this day. Every oriental scholar knows that the people of these countries look upon consonants as the stamina of words. Accordingly, in writing letters, in dispatches upon business, and all affairs of small moment, the vowels are generally omitted. It is obvious, that in every original language the sound of the vowels is variable and of little importance. Such was the case with the Hebrew tongue: Nor do we think that the natives of the country would find it a matter of much difficulty to learn to read without the help of the vowels. They knew the words beforehand, and so might readily enough learn by practice what vowels were to be inserted.

When the Hebrew became a dead language, as it certainly was in a great measure to the vulgar after the return from the Babylonish captivity; such subsidiaries might we think, have been useful, and of course might possibly have been adopted for the use of the vulgar: but the scribe, the lawyer, and the learned rabbi, probably disdained such beggarly elements. We shall in this place hazard a conjecture, which, to us at least, is altogether new. We imagine that the Phœnicians, who were an inventive, ingenious people, had, prior to the age of Cadmus, who first brought their letters into Greece, adopted the more commodious method of inserting the vowels in their proper places; whereas the Jews, zealously attached to the customs of their ancestors, continued to write and read without them. In this manner the Gephuræi *, who were the followers of Cadmus, communicated them to the Jones their neighbours. We are convinced that the materials of the Greek tongue are to be gleaned up in the east; and upon that ground have often endeavoured to trace the origin of Greek words in the Hebrew, Phœnician, Chaldean, and Arabian languages. Reading without the vowel points we have seldom failed in our search; but when we followed the method of reading by the Masoretic points, we seldom succeeded; and this, we believe, every man of tolerable erudition who will make a trial will find by experience to be true. This argument appears to us superior to every objection. Upon this basis, the most learned Bochart has erected his etymological fabric, which will be admired by the learned and ingenious as long as philology shall be cultivated by men.

35 **Proof that the Masoretic points are modern.**

It has been urged by the zealots for the Masoretic system, that the Arabians and Persians employ the vowel points. That they do so at present is readily granted; but whether they did so from the beginning seems to be the question. That Arabia was overspread with Jewish exiles at a very early period, is abundantly certain. It was natural for them to retire to a land where they would not hear of war nor the sound of the trumpet. Accordingly we find that, prior to the age of the Arabian impostor, Arabia swarmed with Jewish settlements. From these Jews, it is highly probable that their neighbours learned the use of the points in question; which in the course of their conquests the Saracens communicated to the Persians.

It has been alleged with great show of reason, that without the vowel points, it is often impossible to develope the genuine signification of many words which occur frequently in the language: many words of different and sometimes opposite significations are written with exactly the same consonants. Without the points, then, how are we to know the distinction? In answer to this objection, we beg leave to observe, that, during the first period of a language, it is impossible that there should not occur a number of similar sounds of different significations. This is surely to be attributed to the poverty of the language. When a few terms have been once fabricated, men will rather annex new significations to old terms, than be at the expense of time or thought to invent new ones. This must have been the case with the Hebrew in particular; and indeed no language on earth is without instances of this inconveniency, which, however, in a living tongue, is easily overcome by a difference of accent, tone, gesture, pronunciation; all which, we think, might obviate the difficulty.

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* *Herod.* lib. i. cap. 56.

(z) This is so true, that, according to Hesychius and Suidas, φοινικιζειν, to act the Phœnician, signified "to read.

From the preceding arguments, we think ourselves authorised to infer that the Masora is a novel system, utterly unknown to the most ancient Jews, and never admitted into those copies of the Scriptures which were deemed most sacred and most authentic by that people.

With respect to the original introduction of the points, we agree with the learned and judicious * Dr Prideaux, who imagines that there were gradually introduced after the Hebrew became a dead language, with a view to facilitate the learning to read that language, more especially among the vulgar. By whom they were introduced, we think, cannot easily be determined; nor is it probable that they were all introduced at once, or by one and the same person. They have been ascribed to Ezra by many, for no other reason that we can discover but to enhance their authenticity, and because the sentiment is analogous to the other articles of reformation established by that holy priest. If our curious reader should not be satisfied with the preceding detail, we must remit him to Capellus and Morinus on the one side, and the two Buxtorfs, Schultens, and Dr James Robertson late professor of oriental languages in the university of Edinburgh, on the other. This learned orientalist, in his dissertation prefixed to his *Clavis Pentateuchi*, has collected and arranged, with the true spirit of criticism, every thing that has been advanced in favour of the Masoretical system.—*Si Pergama dextra defendi possent, etiam hac defensa fuissent.*

35 From Origen's Hexapla.

St Origen, who flourished about the beginning of the 3d century, was a profound Hebrew scholar. He published a most laborious and learned work, which is generally called the *Hexapla*, because it consisted of six columns; the first of which contained the Hebrew text; the second, the same text, but written in Greek characters: the third column exhibited the version of Aquila; the fourth that of Symmachus; the fifth, the Septuagint; and the sixth, the version of Theodotion. In some fragments of that vast work which are still extant, we have a specimen of the manner in which the Hebrew was pronounced in the third century, by which it appears that it was very different from that which results from observing the Masoretical points. The following is an instance copied from the beginning of Genesis.

According to ORIGEN.

Brêsith bara Elôeim eth asamaim oueth aares.

Ouaares aietha Thôau. ouboou ouôsekh al phne Theôm ourouê elôeim maraepheth al phne amaim.

Quiômer elôeim iei ôr ouiei ôr.

Ouiar elôeim eth aôr khi tôb ouiabdêl elôeim bên aôr oubên aôsekh.

According to the MASORITES.

Bereshith bara Elohim eth ashamajim veeth aaretz.

Veaaretz ajetha thoou vaboou, vekhoshek gnal pené theom verouakh elohim merakhepheth gnal pené hammáim.

Vaïomer elohim jehi or, vajehi or.

Vajare elohim eth aor ki tob vajabedel elohim bein aor oubein hakhoshek.

37 and the practice of the ancient Greeks.

Upon the whole, we presume to give it as our opinion, that in the most early periods, the vowels, *aleph*, *he*, *jod* or *yod*, *vaw* or *waw*, and perhaps *ain* or *ajin*, were regularly written wherever they were sounded. This to us appears plain from the practice of the ancient Greeks. It is agreed on all hands that the Samaritan and Phœnician alphabets were the same; and that the former was that of the Jews originally. The Phœnicians certainly wrote the vowels exactly, for so did the Greeks who copied their alphabet: If the Phœnicians wrote their vowels, so then did the Jews of the age of Cadmus; but Cadmus was contemporary with some of the earliest judges of Israel; the consequence is evident, namely, that the Jews wrote their vowels as late as the arrival of that colony-chief in Greece. We ought naturally to judge of the Hebrew by the Chaldaic, Syriac, and Arabian, its sister dialects. All these languages in ancient times had their vowels regularly inserted; and why not the Hebrew in the same manner with the rest?

As these first vowels which were coeval with the other letters, often varied in their sound and application, the points, in all appearance, were first invented and employed to ascertain their different sounds in different connections. Other marks might be invented to point out the various tones of voice, like the *τονοι*, or accents, with which the vowels were to be enounced, as was done among the later Greeks. In process of time, in order to promote celerity of writing, the vowels were omitted, and the points substituted in their place.

Before we conclude our observations on the Hebrew language, we ought, perhaps, to make an apology for omitting to interlard our details with quotations from the two Talmuds, the Mishna, the Gemara, the Cabbalas, and a multitude of rabbinical writers who are commonly cited upon such an occasion. We believe we could have quoted almost numberless passages from the two Buxtorfs, Father Morin, Capellus, and other Hebrew critics, with no great trouble to ourselves, and little emolument to the far greater part of our readers. But our opinion is that such a pedantic display of philological erudition would probably have excited the mirth of our learned, and roused the indignation of our unlearned, readers. Our wish is, to gratify readers of both descriptions, by contributing to the edification of one class without disgusting the other.

We cannot, we imagine, fairly take leave of the sacred language, without giving a brief detail of those excellencies, which, in our opinion, give it a just claim to the superiority over those other tongues which have sometimes contended with it for the prize of antiquity:

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* Connect. part i. book i.

quity: and of these the following in our apprehension deserve particular notice.

38
Excellencies of the Hebrew language.

If this language may claim any advantage over its antagonists, with respect to its being rather a mother than a daughter to any of them, it is undoubtedly in consequence of its simplicity, its purity, its energy, its fecundity of expressions and significations. In all these, notwithstanding its paucity of words, it excels the vast variety of other languages which are its cognate dialects. To these we may add the significancy of the names, both of men and brutes; the nature and properties of the latter of which are more clearly and more fully exhibited by their names in this than in any other tongue hitherto known. Besides, its well authenticated antiquity and the venerable tone of its writings surpass any thing left upon record in any other dialect now extant in the world. These extraordinary qualities excite our admiration at present under every disadvantage; and from this circumstance we may infer its incomparable beauty in the age of the Jewish legislator, and what effects it would naturally produce, could we know it now as it was spoken and written in the days of David and Solomon.

As far, however, as we understand it in its present mutilated condition, and are able to judge of its character from those few books that have come down to our time, we plainly perceive that its genius is simple, primitive, natural, and exactly conformable to the character of those uncultivated patriarchs who used it themselves, and transmitted it to their descendants in its native purity and simplicity. Its words are comparatively few, yet concise and expressive; derived from a very small number of radicals, without the artificial composition of modern languages. No tongue, ancient or modern, can rival it in the happy and rich fecundity of its verbs, resulting from the variety and significancy of its conjugations; which are so admirably arranged and diversified, that by changing a letter or two of the primitive, they express the various modes of acting, suffering, motion, rest, &c. in such a precise and significant manner, that frequently in one word they convey an idea which, in any other language, would require a tedious paraphrase. These positions might easily be illustrated by numerous examples; but to the Hebrew scholar these would be superfluous, and to the illiterate class neither interesting nor entertaining.

To these we may add the monosyllabic tone of the language, which, by a few prefixes and affixes without affecting the radix, varies the signification almost at pleasure, while the method of affixing the person to the verb exhibits the gender of the object introduced. In the nouns of this language there is no flexion except what is necessary to point out the difference of gender and number. Its cases are distinguished by articles, which are only single letters at the beginning of the word: the pronouns are only single letters affixed; and the prepositions are of the same character prefixed to words. Its words follow one another in an easy and natural arrangement, without intricacy or transposition, without suspending the attention or involving the sense by intricate and artificial periods. All these striking and peculiar excellencies combined, plainly demonstrate the beauty, the stability, and antiquity of the language under consideration.

We would not, however, be thought to insinuate that this tongue continued altogether without changes and imperfections. We admit that many radical words of it were lost in a course of ages, and that foreign ones were substituted in their place. The long sojourning of the Israelites in Egypt, and their close connection with that people, even *quoad sacra*, must have introduced a multitude of Egyptian vocables and phrases into the vulgar dialect at least, which must have gradually incorporated with the written language, and in process of time have become part of its essence. In Egypt, the Israelites imbibed those principles of idolatry which nothing less than the final extirpation of their polity could eradicate. If that people were so obstinately attached to the Egyptian idolatry, it is not very probable that they would be averse from the Egyptian language. Besides, the Scripture informs us, that there came up out of Egypt *a mixed multitude*; a circumstance which must have infected the Hebrew tongue with the dialect of Egypt. As none of the genuine Hebrew radicals exceed three letters, whatever words exceed that number in their radical state may be justly deemed of foreign extraction.

Some Hebrew critics have thought that verbs constitute the radicals of the whole language; but this opinion appears to us ill founded: for though many Hebrew nouns are undoubtedly derived from verbs, we find at the same time numbers of the latter deduced from the former.

39
Hutchinsonianism.

Before we conclude our detail of the Hebrew tongue, a few of our readers may possibly imagine that we ought to give some account of the Hutchinsonian system; a system so highly in vogue not many years ago. But as this allegorical scheme of interpretation is now in a manner exploded, we shall beg leave to remit our curious Hebraist to Mr Holloway's Originals, a small book in 2 vols 8vo, but replete with multifarious erudition, especially in the Hutchinsonian style and character.—*Fides sit penes autorem.*

SECT. II. *The Arabic Language.*

40
Arabic language originally Hebrew.

We now proceed to give some account of the Arabian language, which is evidently one of the sister dialects of the Hebrew. Both, we imagine, were originally the same; the former highly improved and enlarged; the latter, in appearance, retaining its original simplicity and rude aspect, spoken by a people of a genius by no means inventive. In this inquiry, too, as in the former, we shall spare ourselves the trouble of descending to the grammatical minutiæ of the tongue; a method which, we are persuaded, would neither gratify our learned nor edify our unlearned readers. To those who are inclined to acquire the first elements of that various, copious, and highly improved tongue, we beg to recommend *Erpenii Rudimenta Ling. Arab.*; *Golii Gram. Arab.*; the Dissertations of Hariri, translated by the elder Schultens; Mr Richardson's Persic and Arabic Gram. &c.

We have pronounced the Hebrew and Arabian sister dialects; a relation which, as far as we know, has been seldom controverted: but we think there is authentic historical evidence that they were positively one and the same, at a period when the one as well as the other appeared in its infant unadorned simplicity. The following detail will, we hope, fully authenticate the truth of our position.

† Gen. x. 25.

"Unto Eber (says the Scripture †) were born two sons. The name of one was Peleg, because in his days the earth was divided; and his brother's name was Joktan," or rather Yoktan. This last, says the sacred historian, "had thirteen sons; and their dwelling reached from Mesha (Mocha) to Sephar (A)," a mount of the east. According to this account, the descendants of Yoktan possessed all the maritime coasts of Arabia from Mesha (Mocha) to Mount Sephar towards the east of that peninsula. Moses, describing the rivers of paradise, tells us, that one of the branches of that river ‡ "encompassed the whole land of Havilah, where there was great store of gold." Havilah was the twelfth son of Yoktan, whom the Arabians call Kobtan; and consequently his territory was situated towards the eastern limit of the possessions of the posterity of the youngest son of Eber. Yoktan or Kobtan was too young to be concerned in the building of the tower; and consequently retained the language of his family, which was undoubtedly the Hebrew. His descendants must have carried the same language into their respective settlements, where it must have been transmitted to succeeding generations. The original language of all the tribes of the Arabians who inhabit a vast tract of country along the southern shore, according to this deduction, was that of their father Kobtan, that is, the Hebrew. Indeed, the most learned Arabians of modern times unanimously acknowledge this patriarch as the founder of their language as well as of their nation.

‡ Gen. ii. 11.

The other districts of Arabia were peopled by the offspring of Abraham. The Ishmaelites, the posterity of that patriarch by Hagar, penetrated into the very centre of the peninsula; incorporated, and in process of time became one people with the Kobtanites. Another region was possessed by the children of the same holy man by Cheturah his second wife. The Moabites, Ammonites, Edomites, Amalekites, &c. who settled in the various regions of Arabia Petræa, were all branches of Abraham's family, and used the same language with their great progenitor. The Scripture indeed speaks of people who inhabited the country last mentioned prior to the branches of Abraham's family; but these, according to the same history, were extirpated by the former. The conclusion then is, if we credit the Mosaic account, that all the inhabitants of the three divisions of Arabia did, in the earliest periods, universally use the Hebrew tongue.

There was, we are sensible, a region of Arabia inhabited by the Cushim, or descendants of Cush. This district was situated on the confines of Babylonia. Our translators have confounded this country with the modern Ethiopia; and have consequently ascribed the exploits of the Arabian Cushim to the Ethiopians. The Arabian kings of Babylon were of those Cushim. These were conquered and expelled Babylonia by the Chasidim. These spoke the Chaldean dialect, as will appear when we come to speak of that of the Abyssinians. Here the candid reader is desired to reflect that the Hebrew and Chaldaic are cognate dialects.

The foregoing proofs, deduced from the Mosaic history, will be corroborated by a mass of internal evidence in the succeeding parts of our inquiry.

41 Gradually deviated from that simplicity.

The Arabic tongue, originally pure Hebrew, was in process of time greatly transformed and altered from its simple unsophisticated state. The Arabians were divided into many different tribes; a circumstance which naturally produced many different dialects. These, however, were not of foreign growth. No foreign enemy ever conquered those independent hordes. The Persians, Greeks, and Romans, sometimes attempted to invade their territories; but the roughness of the ground, the scarcity of forage, the penury of water, and their natural bravery, always protected them. They were indeed once invaded by the Abyssinians or Ethiopians with some show of success; but these invaders were in a short time expelled the country. Their language, of consequence, was never adulterated with foreign words or exotic phrases and idioms. Whatever augmentations or improvements it received were derived from the genius and industry of the natives, and not from adventitious or imported acquisitions. From this circumstance we may justly infer, that the Arabian tongue was a long time stationary, and of course differed in no considerable degree from its Hebrew archetype. The learned Schultens, in his Commentary on Job, hath shown, to the conviction of every candid inquirer, that it is impossible to understand that sublime composition without having recourse to the Arabic idioms. That patriarch was a Chuzite. His country might be reckoned a part of Arabia. His three friends were actually Arabians, being the descendants of Ishmael and Esau. His country bordered with that of the predatory Chaldeans, who were an Arabian banditti. When we consider all these circumstances *in cumulo*, we are strongly inclined to believe that the book of Job was actually written in Arabic, as the language stood at that period; which, according to the most probable opinion, could not have been later than the age of Moses. The learned are generally agreed that this whole book, the three first chapters excepted, is a poetical composition, replete with the most brilliant and most magnificent imagery, the boldest, the justest, and most gorgeous tropes and allusions, and a grandeur of sentiment wholly divine. Whoever has read the poetical compositions of the modern Arabians, on divine subjects, with any degree of taste, will, we flatter ourselves, discover a striking similarity both of diction and sentiment. Be this as it may, we think there is no reason to conclude that the Arabic dialect deviated much from the Hebrew standard prior to the Christian era.

42 The two principal dialects of Arabia.

Of those different dialects which prevailed among the various tribes among which the peninsula of Arabia was divided, the principal were the Hemyaret and the Koreish. Though some of these were tributary to the Tobbas, or Hemyaret sovereign of Arabia Felix, yet they took no great pains to cultivate the language of that province, and of course these people did not thoroughly

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(A) Sephar, in the Septuagint Σωφηρα, and in some editions Σωφειρα: hence probably Σωφιρ. *Orig. in Job* chap. xxii. ver. 14. φασιδε τινες των Ερμηνευτων Σωφιρ την Αφρικην ειναι.

roughly understand it. As for the independent tribes, they had no temptation to cultivate any other language than their own.

43 The dialect of the Koreish became the politest, and why.

The Koreish tribe was the noblest and the most learned of all the western Arabs; and the kaaba, or square temple of Mecca, was before the era of Mohammed solely under their protection. This temple drew annually a great concourse of pilgrims from every Arabian tribe, and indeed from every other country where the Sabian religion prevailed. The language of the Koreish was studied with emulation by the neighbouring tribes. Numbers of the pilgrims were people of the first rank, and possessed all the science peculiar to their country or their age. Great fairs were held during their residence at Mecca, and a variety of gay amusements filled up the intervals of their religious duties. In these entertainments literary compositions bore the highest and most distinguished rank; every man of genius considering not his own reputation alone, but even that of his nation or his tribe, as interested in his success. Poetry and rhetoric were chiefly esteemed and admired; the first being looked upon as highly ornamental, and the other as a necessary accomplishment in the education of every leading man. An assembly at a place called *Ocadh*, had been in consequence established about the end of the sixth century, where all were admitted to a rivalship of genius. The merits of their respective productions were impartially determined by the assembly at large; and the most approved of their poems, written on silk, in characters of gold, were with much solemnity suspended in the temple, as the highest mark of honour which could be conferred on literary merit. These poems were called the *Moallabat*, "suspended," or *Modhabebat*, "golden." Seven of these are still preserved in many European libraries.

From this uncommon attention to promote emulation, and refine their language, the dialect of the Koreish became the purest, the richest, and the most polite, of all the Arabian idioms. It was studied with a kind of predilection; and about the beginning of the seventh century it was the general language of Arabia, the other dialects being either incorporated with it, or sliding gradually into disuse. By this singular idiomatic union the Arabic has acquired a prodigious fecundity; whilst the luxuriance of synonymes, and the equivocal or opposite senses of the same or similar words, hath furnished their writers with a wonderful power of indulging, in the fullest range, their favourite passion for antithesis and quaint allusion. One instance of this we have in the word *veli;* which signifies a *prince*, a *friend*, and also a *slave*. This same word, with the change of one letter only, becomes *vali;* which, without equivocation, imports a *sovereign*. Examples of this kind occur in almost every page of every Arabic dictionary.

44 This superiority modern.

But all these advantages of this incomparable language are merely modern, and do not reach higher than the beginning of the sixth century. Prior to that era, as we have observed above, a variety of dialects obtained; and as the Arabs were by their situation in a manner sequestered from all the rest of mankind, it may not perhaps be superfluous to inquire briefly into the cause and origin of this instantaneous and universal change.

For a course of more than 20 centuries, the Arabians had been shut up within the narrow limits of their own peninsula, and in a great measure secluded from the rest of the world. Their commerce with India was purely mercantile, and little calculated to excite or promote intellectual improvements. They traded with the Egyptians from time immemorial; but since the invasion and usurpation of the pastor kings, every shepherd, that is, every Arabian, was an abomination to the Egyptians. From that quarter, therefore, they could not derive much intellectual improvement. Besides, when an extensive territory is parcelled out among a number of petty septs or clans, the feuds and contests which originate from interfering interests and territorial disputes, leave but little time, and less inclination, for the culture of the mind. In these circumstances, the military art alone will be cultivated, and the profession of arms alone will be deemed honourable. Of consequence, we find that, in the general opinion, poetry, rhetoric, and the profession of arms, were the only sciences cultivated by the people in question. As for the science of arms, we are convinced that it was both studied and practised at a very early period; but as to the two former, we imagine they were very late acquisitions, and sprung from some circumstance external and adventitious.

The tribe of the Koreish were much engaged in commerce. They exported frankincense, myrrh, cassia, galbanum, and other drugs and spices, to Damascus, Tripoli, Palmyra, and other commercial cities of Syria and its neighbourhood. Upon these occasions the Arabian traders must have become acquainted with the Greek language, and perhaps with the more amusing and affecting parts of the Grecian literature. They might hear of the high renown of Homer and Demosthenes; and it is not impossible that some of them might be able to read their compositions. Every body knows with what unremitting ardour the learned Arabs, under the first caliphs, perused and translated the philosophical works of the Grecian sages. The very same spirit might animate their predecessors, though they wanted learning, and perhaps public encouragement, to arouse their exertions. From this quarter, we think, the Arabs may have learned to admire, and then to imitate, the Grecian worthies.

The Ptolemies of Egypt were the professed patrons of commerce as well as of learning. Under these princes all nations were invited to trade with that happy country. The Arabs, now no longer fettered by Egyptian jealousy, carried their precious commodities to Alexandria; where the Grecian literature, though no longer in its meridian splendour, shone however with a clear unfaded lustre. The court of the first Ptolemies was the retreat of all the most celebrated geniuses of Greece and of the age; in a word, Alexandria was the native land of learning and ingenuity. Here the ingenious Arab must have heard the praises of learning incessantly proclaimed; must have been often present at the public exhibitions of the poets and orators; and even though he did not understand them exactly, might be charmed with the melody of the diction, and struck with surprise at their effects on the audience. The reader will please to reflect, that the Arabian traders were the first men of the nation, both with respect to birth, learning, and fortune. These wise men, to use the language of Scripture, inspired with the natural curiosity of their race, might hear of the celebrated Olympic games, the public recitations before that assembly, and the

45 Institution at Mecca similar to the Olympic games.

the glorious prize bestowed upon the conquerors. Such information might animate them to institute something parallel at Mecca, with a view to improve their language, and at the same time to derive honour and emolument to themselves. The Koreishim might promise themselves the like advantages from the establishment of the fair and assembly at Ocadh, as the natives of Elis drew from the institution of the Olympic games. For these reasons, we conjecture, the literary competitions at the place just mentioned were instituted at so late a period, though the nation had existed more than 2000 years before the establishment of this anniversary. Upon the whole, we are inclined to believe, that the Arabs, notwithstanding all the fine things recorded of them by their own poetical historians, and believed perhaps too easily by those of other countries, were in the days of ignorance like the earliest Romans, *latrones et semibarbari*. For our part, we think it by no means probable, that a people of that character should, after so long a course of years, have stumbled upon so laudable and so beneficial an institution, without taking the hint from some foreign one of a similar complexion. This we acknowledge is only a conjecture, and as such it is submitted to the judgment of the reader.

There were, as has been observed above, two principal dialects of the original Arabic: The Hamyarite spoken by the genuine Arabs, and the Koreishite or pure Arabic, which at last became the general language of that people. The former of these inclined towards the Syriac or Chaldean; the latter being, according to them, the language of Ishmael, was deeply tinctured with the Hebrew idiom. The oriental writers tell us that Terah, the grandfather of Hamyar, was the first whose language deviated from the Syriac to the Arabic. Hence, say they, the Hamyaritic dialect must have approached near to the purity of the Syriac, and of consequence must have been more remote from the true genius of the Arabic than that of any of the other tribes. The fact seems to stand thus: The Hamyarites were neighbours to the Chaldeans and Syrians, and consequently were connected with those people by commerce, wars, alliances, &c. This circumstance introduced into their language many phrases and idioms from both these nations. That Terah was concerned in adulterating the dialect of the Hamyarites, is a mere oriental legend, fabricated by the Arabs after they began to peruse the Hebrew Scriptures. The Koreish being situated in the centre of Arabia, were less exposed to intercourse with foreigners, and therefore preserved their language more pure and untainted.

46
The Koran written in the Koreish dialect.

The learned well know, that the Koran was written in the dialect of the Koreish; a circumstance which communicated additional splendour to that branch of the Arabian tongue. It has been proved, that the language of the original inhabitants of Arabia was genuine Hebrew; but upon this supposition a question will arise, namely, whether the Arabians actually preserved their original tongue pure and unsophisticated during a space of 3000 years, which elapsed between the deluge and birth of Mohammed? or, whether, during that period, according to the ordinary course of human affairs, it underwent many changes and deviations from the original standard?

The admirers of that language strenuously maintain the former position; others, who are more moderate in their attachment, are disposed to admit the latter. Chardin observes of the oriental languages in general, that they do not vary and fluctuate with time like the European tongues.* "Ce qu'il y a de plus admirable, dit il, et de plus remarquable, dans ces langues, c'est, qu'elles ne changent point, et n'ont point changé du tout, soi à l'egard de termes, soit à l'égard du tour: rien n'y est, ni nouveau ni vieux, nulle bonne façon de parler n'a cessé *d'etre* en credit. L'Alcoran, par exemple, est aujourdhui, comme il y a mille années, le modele de plus pure, plus courte, et plus eloquente diction." It is not to our purpose to transcribe the remaining part of the author's reflection upon this subject: From the above it plainly appears that he concludes, that the Arabian tongue has suffered no change since the publication of the Koran; and at the same time insinuates, that it had continued invariable in its original purity through all ages, from the days of Kohtan to the appearance of that book. Whether both or either of these sentiments is properly authenticated will appear in the sequel.

47
Means adopted by the Arabs to preserve the purity of their language.

The learned Dr Robertson, late professor of oriental languages in the university of Edinburgh, informs us, that the Arabians, in order to preserve the purity of their language, strictly prohibited their merchants, who were obliged to go abroad for the sake of commerce, all commerce with strange women. We know not where this injunction is recorded, but certainly it was a most terrible interdict to an amorous son of the desert. If such a prohibition actually existed, we suspect it originated from some other source than the fear of corrupting their language. Be that as it may, the Doctor, as well as the great Schultens, is clearly of opinion, that the language in question, though divided into a great number of streams and canals, still flowed pure and limpid in its course.

Our readers who are acquainted with the history of the orientals are already apprized of the steady attachment of those people to ancient customs and institutions. We readily allow, that in the article of Language this same predilection is abundantly obvious; but every oriental scholar must confess, that the style of the Koran is at this day in a manner obsolete, and become almost a dead language. This fact, we believe, will not be questioned. If the Arabian has deviated so very considerably from the standard of the Koran in little more than 1000 years, and that too after an archetype is ascertained; by a pariety of reason we may infer, that much greater deviations must have affected the language in the space of 3000 years.

48
The style of the Koran now obsolete.

It is universally allowed by such as maintain the unsullied purity of the Arabian tongue, that it was originally the same with the Hebrew, or with the ancient Syriac and Chaldaic. Let any one now compare the words, idioms, and phraseology of the Koran with the remains of those three languages, and we think we may venture to affirm that the difference will be palpable. This circumstance, one would think, indicates in the strongest terms a remarkable alteration.

The Arabs themselves are agreed, that, notwithstanding the amazing fecundity of their language, vast numbers of its radical terms have been irrecoverably lost. But this loss could not be supplied without either fabricating new words or borrowing them from foreign languages. To the latter method we have seen their aversion;

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* *Voyage*, vol. iii. p. 43.

sion; and must therefore conclude that they adopted the former.

The Chaldeans, Syrians, and Phœnicians, had made innovations on their language at a very early period, even before conquests were undertaken: We see no reason to suppose that the Arabs did not innovate as well as their nearest neighbours: the Hamyarites did actually innovate.

There are, we think, very strong reasons to believe, that Job was an Arabian, and flourished prior to Moses, perhaps as early as Jacob. The style, the genius, the figurative tone of the composition; the amazing sublimity of the sentiments, the allusions, the pathos, the boldness, the variety, and irregularity, the poetical enthusiasm which pervades the whole poem, strongly breathe the Arabian spirit: indeed the very diction is peculiar to that single book, and differs widely from that of the Psalms and every poetical part of the sacred canon. If we compare this book with Mohammed's Koran, we shall scarce find any resemblance of words or phraseology; but a wonderful similarity of figures, enthusiasm, and elevation of sentiments.

49
and resembling the Hebrew in its phraseology.

We are then led to conclude, that the Arabic did actually lose and gain a multitude of vocables between the era of its first establishment among the descendants of Joktan and Ishmael, and the birth of the impostor.

The art of writing was introduced among the Arabs at a very late period: Without the assistance of this art, one would think it altogether impossible to preserve any language in its primeval purity and simplicity. Our curious readers may here expect some account of the Arabic characters: the following detail is the most probable one we have been able to collect on that subject.

50
Art of writing among the Hamyarites,

It is generally agreed *, that the art of writing was known among the Hamyarites or Homerites at a very early period. These people were sovereigns of Arabia during a course of many years. Their character was somewhat perplexed and confused. It was called *al Mosnad*, from the mutual connection of the letters. The alphabet of these people resembled that of the Hebrews both in the number and order of the letters, and is called *abgad hevis* †, from the first ten letters of the Hebrew alphabet, artificially thrown together. "And this word (says the learned Chardin ‡) *a*, *b*, *g*, *d*, is formed of the four letters which were heretofore the first in the Arabian language, as they are still in that of the Hebrews." The same traveller is positive that these were the ancient characters of the Arabs; that they differed from Cuphite letters, which were afterwards introduced; and that they were furnished with vowel points. These, we imagine, were the first sketches of the Chaldean character, which probably the Hamyarites retained in their pristine unpolished form, after they had been polished and reduced to a more elegant size by the original inventors.

* Pococke's Specim. Hist. Arab.

† Id. ibid.

‡ Vol. iii. p. 153.

Monuments bearing inscriptions in these characters are, they tell us, still to be seen in some places of Arabia. Some were engraved on rocks; and to these we think it probable that the patriarch Job alludes in those passages where he seems to intimate an inclination to have his sufferings recorded in a book, and graven in the rock for ever. All the Arabians agree, that the dialect of the Hamyarites inclined towards the Syriac or Chaldean. This we have imputed to the connection of that people with the Chaldeans, who lived in their neighbourhood. If the Hamyaritic dialect was infected with the Syriac or Chaldaic, there can be no doubt that they derived their letters from the same quarter.

51
in Chaldaic characters.

We conclude then, that the Hamyarites knew the art of writing from the earliest antiquity, and that the letters they employed were the rude Chaldaic in their unimproved state *. Some of the Arabians do indeed hold, that Ishmael was the first author of letters; but that his characters were rude and indistinct, without any interval between letters or words, and that these were adopted by Kedar and his other children: but this tradition hath met with little credit.

* Pococke Orat. de Ling. Arab.

With respect to the highly polished Koreishites, it is agreed on all hands, that they were unacquainted with the use of letters till a few years before the birth of Mohammed. Two difficulties here present themselves. The first is, how the Koreishite dialect, without the art of writing, happened to excel all the other dialects of the Arabic tongue, assisted by that art, apparently so necessary for preserving a language in its original purity. The second is still, we think, rather greater, namely, how the Koreish learned that most useful art at so late a period as the sixth century. It is a well known fact, that ever after the Babylonish captivity Arabia swarmed with Jewish villages, in which the art of writing was generally known; and almost at the beginning of the Christian era, multitudes of Christians retired to the same country, in order to avoid the persecutions which they suffered in the Roman empire. In these circumstances, we think it rather strange, that the Koreishites, highly polished and acute as they were, never thought of laying hold on the opportunity of learning an art so very useful. These two problems we leave to be solved by our more learned readers.

52
Art of writing among the Koreishites.

But however they be solved, it is universally acknowledged, that the Koreish were ignorant of letters till a few years before the birth of their prophet. Ebn Chalican (B), one of their most celebrated historians, informs us, that Moramer the son of Morra, an Anbarian, a native of Anbaris, a city of Irak (c), first invented alphabetical characters, and taught his countrymen to use them, from whom this noble invention was derived to the Koreishites. These letters, though neither beautiful nor convenient, were long used by the Arabs. They were denominated *Cuphite*, from *Cupha*, a city of Irak. In this character the original copy of the Koran was written. These we think were the original clumsy characters which were retained by the vulgar, after the beautiful square Chaldaic letters were invented, and probably used by priests, philosophers, and the learned

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(B) See this whole detail in Dr Pococke's *Specim. Hist. Arab.* p. 250. *et seq.*

(B) *Irack*, "Babylonia," from *Erech*, one of the cities built by Nimrod. The Arabians have generally restored the ancient names of places. Thus, with them Tyre is *Tzur*, Sidon *Seyd*, Egypt *Mezri*, &c.

learned in general. These letters are often at this day used by the Arabs for the titles of books and public inscriptions.

53
Improved about 300 years after Mohammed.

Abauli the son of Mocla *, about 300 years after the death of Mohammed, found out a more elegant and more expeditious character. This invention of Abauli was afterwards carried to perfection by Ebn Bowla, who died in the year of the Hegira 413, when Kader was caliph of Bagdad. This character, with little variation, obtains at this day. As we think this article of some importance, we shall, for the sake of our unlearned readers, transcribe an excellent account of this whole matter from the very learned Schultens.

"The Cuphic character, says he, which had been brought from the region of the Chaldeans to the province of Hejaz, and to Mecca its capital, in the age of Mohammed, was employed by the Koreishites, and in it the Koran was first written. But as this character was rude and clumsy, in consequence of its size, and ill calculated for expedition, Abauli Ebn Mocla devised a more elegant and expeditious one. This person was visir to Arradius the 41st caliph, who began to reign in the year of the Hegira 322. Accordingly, in the 10th century, under this emperor of the Saracens, the form of the Arabian alphabet underwent a change; and the former clumsy embarrassed character was made to give way to the polished, easy, and expeditious type. Regarding this expedition alone, the author of the invention left very few vowel characters; and as the Hebrew manner of writing admits five long ones and five short in different shapes, he taught how to express all the vowels, both long and short, suitably to the genius of the language, by three, or rather by two, small points, without any danger of a mistake: an abbreviation truly deserving applause and admiration; for by placing a very small line above ٮَ he expressed *a* and *e*; and by placing the same below ٮِ he meant to intimate *i* only. To the other short ones, *o* and *u*, he assigned a small *waw* above. In order to represent the long ones, he called in the *matres lectionis*, the "quiescent letters א, ו, י;" so that *phata* with *elif* intimated *a* and *o* long, i. e. *kametz* and *cholem*; *jod* placed after *kefram* became *tzeri* and *chirek* long. *Waw* annexed to *damma* made *schurek*."

In this passage, the great orientalist acknowledges that the visir above mentioned, who carried the Arabian alphabet to the pinnacle of perfection, invented and annexed the vowel points for the sake of ease and expedition in writing; from which we may infer, that prior to the tenth century the Arabians had no vowel points; and consequently either read without vowels, or contented themselves with the *matres lectionis* above mentioned.

The design of the author of the invention, in fabricating these points, was confessedly ease and expedition in writing; a circumstance which furnishes a violent presumption that the Hebrew vowel-points were devised and annexed at some late period for the very same purposes.

Some, indeed, have gone so far as to affirm that the Arabians were the original fabricators of the vowel-points. "The Arabians † (says the learned Dr Gregory Sharp) were the original authors of the vowel points. They invented three, called *fatha*, and *damma*, and *kesra*: but these were not in use till several years after Mohammed; for it is certain that the first copies of the Koran were without them. The rabbis stole them from the Arabs." This, however, is carrying the matter too far, since it is certain that the Jews were acquainted with the points in question long before the period above mentioned.

54
Surprising extent of the Arabic language.

Though it is not our intention to enter into a minute detail of the peculiarities of this noble language, we cannot omit observing one thing, which indeed belongs to grammar, but is not generally taken notice of by the Arabic grammarians. The roots of verbs in this dialect are universally triliteral; so that the composition of the 28 Arabian letters would give near 22,000 elements of the language. This circumstance demonstrates the surprising extent of it: for although great numbers of its roots are irrecoverably lost, and some perhaps were never in use; yet if we suppose 10,000 of them, without reckoning quadriliterals, to exist, and each of them to admit only five variations, one with another, in forming derivative nouns, the whole language would then consist of 50,000 words, each of which may receive a multitude of changes by the rules of grammar.

Again, the Arabic seems to abhor the composition of words, and invariably expresses very complex ideas by circumlocution; so that if a compound word be found in any dialect of that language, we may at once pronounce it of foreign extraction. This is indeed a distinguishing feature in the structure of this tongue, as well as of some of its sister dialects. This circumstance has, in our opinion, contributed not a little to the amazing fecundity of that language: for as every ingredient in the composition of a complex idea requires a word to express it, as many words became necessary to complete the language as there were simple ideas to be intimated by discourse. Were all the compounds of the Greek language to be dissolved, as probably once they were, the vocables of that tongue would infinitely exceed their present number.

The Arabic authors boast most unconscionably of the richness and variety of their language. No human understanding, say they, is capacious enough to comprehend all its treasures. Inspiration alone can qualify one for exhausting its sources *. Ebn Chalawalb, a most renowned grammarian of theirs, has spent a whole volume upon the various names of the lion, which amount to 500; another on the names of the serpent, which make up 200. Mohammed al Firancabodius affirms that he wrote a book on the usefulness and different denominations of honey, in which he enumerates 80 of them; and after all, he assures us that he was still far from having exhausted his subject. To excel in a language so amazingly copious, was certainly a proof of uncommon capacity, and considered as no mean talent even among the Koreishites. Hence Mohammed, when some people were expressing their admiration of the eloquence of the Koran, told them that he had been taught by the angel Gabriel the language of Ishmael, which had fallen into desuetude.

55
Oratory and poetry of the Arabs.

In a language so richly replenished with the choicest and most energetic terms, both oratory and poetry were cultivated with ease. All the difficulty consisted in making a choice among words and phrases equally elegant. We may compare one of those poets or orators to a young gentleman, of a taste highly refined, walking into a repository where a profusion of the richest and most elegant dresses are piled up in wild confusion. Our beau is here distressed with variety; but to be able to choose the most handsome and most becoming, he must have received from nature a superior good taste; which he must likewise have cultivated by assiduous industry, and by associating with the most genteel company.

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* Roberts. Clav. Pent. p. 35, 36.

† Diss. on the Origin of Lan. &c.

* Pococke's Specimen.

The orations of the Arabs were of two kinds, metrical and prosaic. The former they compared to pearls set in gold, and the latter to loose ones. They were ambitious of excelling in both; and whoever did so, was highly distinguished. His success in either of those departments was thought to confer honour, not only on his family, but even on his tribe. In their poems were preserved the genealogies of their families, the privileges of their tribes, the memory of their heroes, the exploits of their ancestors, the propriety of their language, the magnificence of banquets, the generosity of their wealthy chiefs and great men, &c. After all, we cannot avoid being of the unpopular opinion, that this mighty parade of eloquence and poetry did not reach backward above two centuries before the birth of Mohammed, as it certainly vanished at the era of the propagation of his religious institutions. The two succeeding centuries were the reigns of superstition and bloodshed. The voice of the muses is seldom heard amidst the din of arms.

The ancient Arabs, at whatever time poetry began to be in request among them, did not at first write poems of considerable length. They only expressed themselves in metre occasionally, in acute rather than harmonious strains. The Proverbs of Solomon, and the book of Ecclesiastes seem to be composed in this species of versification. The prosody of the Arabs was never digested into rules till some time after the death of Mohammed; and this is said to have been done by Al Khalti al Farabidi, who lived in the reign of the caliph Harun al Raschid.

After so many encomiums on the copiousness of the Arabic tongue, one class of our readers may possibly expect that we should subjoin a brief detail of its genius and character; and this we shall do with all possible brevity.

56 Genius and character of the language.

All the primary or radical words of the language are composed of different combinations of consonants by *triads;* so that the various combinations and conjunctions of radicals make more than 10,000, even without including those which may arise from the meeting of guttural letters. From this quality of the language has flowed that stability of the dialect which has preserved it pure and entire for so many thousand years, and secured it from those changes and that fluctuation to which most other tongues are subject.

Perhaps, notwithstanding its copiousness and variety, no other language can vie with the one in question in point of perspicuity and precision. It is possessed of a brevity and rotundity which, amidst the greatest variety, enables it to express with clearness and energy what could not be expressed in any other tongue without tedious circumlocutions. To this purpose we shall beg leave to transcribe a passage from Bishop Pococke's oration on the Arabic language. As we imagine few of our readers who will have the curiosity to peruse this article can be unacquainted with the Latin tongue, we shall give it as it stands in the original, without a translation:

"Neque in nulla certe laudis parte, mira illa qua, non solum verborum in significando, perspicuitate, sed in prolatione, elegantiæ et dulcedini caverunt, sedulitas; quoque, non solum accurata, inter literas ex significata proportione, sensus sel intensioni, vel remissioni, prout res postulaverit, literarnm appositione, subductione, vel juxta organorum, rationem prospexerunt; sed et ne quid delicatulis auribus ingratum, ne quid horridum, aut *ασυμφωνον*, reperiatur, effecerunt. Hoc in genere est, quod nuspiam in verbo aliquo, genuinæ apud Arabes originis, concurrunt, non intercedente vocalis alicujus motione consonantes, cum vel tres, vel plures, aliis in linguis frequenter collidantur. Immo neque, si adsint, quæ asperitati remedio sint, vocales, quas libet temerè tamen committunt consonantes; sed ita rei natura postulat, ut concurrere debeant illa, quæ se invicem, sine asperitatis inductione consequi, et inter se connecti non possint; illi vel situs, vel literarum mutatione, eas abjiciendo, inserendo, emolliendo, aliisve quibus possent modis, remedia quærunt; adeo ab omni, quod vel absonum, vel dissonum est, abhorrent. Quod si nobis secus videntur, et asperius sonare ab Arabibus prolata, illud auribus nostris, et usui, non linguæ imputandum, nec mollius illis sonare nostra, quam eorum nobis censendum. Quin et gutturalium, quæ nobis maxima asperitatis causa videntur, absentiam, ut magnum in lingua Græca defectum, arguunt Arabes."

The learned Dr Hunt, late professor of the Hebrew and Arabic languages at Oxford, is of the same opinion with the very learned prelate, part of whose oration we have transcribed above, with respect to the delicacy and elegance of the Arabian language:—"Nusquam, mihi credite, (inquit ille) auribus magis parcitur quam in Arabia; nulla lingua à *κακοφωνια*, alienior quam Arabica. Quamquam enim uonnullæ ejus literæ minus fortasse sùaviter, immo durius etiam sonuerint, ita tamen Arabes eas temperarunt cum lenibus, duras cum mollibus, graves cum acutis miscendo, voces inde non minus auribus jucundæ, quam pronunciatu faciles confecerint, totique sermoni miram sonorum tam dulcedinem quam varietatem addiderint. Quod quidem orationis modulandæ studium in Corano adeo manifestum est, ut primi Islamismi oppugnatores eum librum magica ideo arte scriptum dixerint. Non auribus tantum gratus est Arabismus, sed et animi conceptibus exprimendis aptus, sonos suos sententiis semper accommodans, et felici verborum junctura eorum naturam depingens."

To these we might add quotations from Erpenius's oration on the same subject, from Golius, Schultens, Hottinger, Bochart, and Sir William Jones; besides a whole cloud of oriental witnesses, whose extravagant encomiums would rather astonish than edify the far greater part of our readers. These panegyrics may perhaps be in some measure hyperbolical; but in general we believe them pretty well founded. At the same time we are convinced that the Arabic, however melodious in ears of a native, sounds harsh and unharmonious in that of an European.

57 Difficulty of acquiring a thorough knowledge of it.

When we consider the richness and variety of the Arabic tongue, we are led to conclude, that to acquire a tolerable degree of skill in its idioms, is a more difficult task than is generally imagined; at least some people who have acquired the knowledge of the Greek and Latin, and likewise of the more fashionable modern languages, with facility enough, have found it so. Be that as it may, there are two classes of men who, in our opinion, cannot handsomely dispense with the knowledge of that almost universal tongue: the gentleman, who is to be employed in the political transactions of the most respectable mercantile company upon earth, in the eastern parts of the world; and the divine, who applies himself to investigate the true purport of the sacred oracles: without this, the former will often find himself embarrassed in both his civil and mercantile negociations; and the latter will often grope in the dark, when a moderate acquaintance with that tongue would make all sunshine around him.

Bochart, Hottinger, Schultens, Pocock, Hunt, and Robertson, &c. have taken wonderful pains, and lavished a profusion of learning, in proving the affinity and dialectical cognation between the Hebrew and Arabic. Much of this labour, we think, might have been spared. We presume to affirm, that no person tolerably versed in both languages can read a single paragraph of the Arabic version of the New Testament, or indeed of the Koran itself, without being convinced of the truth of this position: it is but stripping the latter of its adventitious frippery, and the kindred features will immediately appear.

The learned professors of the university of Leyden were the first who entered upon the career of Arabian learning. To them the European students are principally indebted for what knowledge of that language they have hitherto been able to attain. Though several Italians have contributed their endeavours, yet the fruit of their labours has been rendered almost useless by more commodious and more accurate works printed in Holland.

The palm of glory, in this branch of literature, is due to Golius, whose works are equally profound and elegant; so perspicuous in method, that they may always be consulted without fatigue, and read without languor. Erpenius's excellent grammar, and his memorable dictionary, will enable the student to explain the history of *Taimur* by *Ibni Arabshah*. If he has once mastered that sublime work, he will understand the learned *Arabic* better than most of the Khatabs of Constantinople or of Mecca.

The Arabian language, however, notwithstanding all its boasted perfections, has undoubtedly shared the fate of other living languages; it has gradually undergone such considerable alterations, that the Arabic spoke and written in the age of Mohammed may be now regarded as a dead language: it is indeed so widely different from the modern language of Arabia, that it is taught and studied in the college of Mecca just as the Latin is at Rome.

The dialect of the Highlands of Yemen is said to have the nearest analogy to the language of the Koran, because these Highlanders have little intercourse with strangers. The old Arabic is through all the East, like the Latin in Europe, a learned tongue, taught in colleges, and only to be acquired by the perusal of the best authors.

" *Ut folia in sylvis pronos mutantur in annos, &c.*"

SECT. III. *Of the Chaldean, Phœnician, Ethiopian or Abyssinian, and Egyptian Languages.*

58 Connection of the Chaldean, Phœnician, Ethiopic, and Egyptian languages.

As there is a very strict connection and dialectical analogy among these languages, we have arranged them all under one section; especially since what is observed relating to one of them may, without the least straining, be extended to them all. We shall begin with the Chaldaic.

The Chaldeans, or Chasidim, as they are always called in Scripture, were the descendants of Chesed the son of Nahor, the brother of Abraham. The descendants of this patriarch drove the Cushim or Arabians out of Babylonia, and possessed themselves of that country at a very early period. As these Chasidim or Chaldeans were the posterity of Nahor, the descendant of Heber, they undoubtedly spoke the original Hebrew tongue as well as the other branches of that family. But being an ingenious inventive people, they seem to have polished their language with much care and delicacy of taste.

The only genuine remains of the ancient Chaldaic language are to be found in the Hebrew Scriptures; and those are contained in 268 verses, of which we have 200 in Daniel, reaching from verse 4th chapter 2d to chapter 8th exclusive; in Ezra 67, in chapter 4th, 17 verses; chapter 5th, the same number; chapter 6th, 18 verses; and in chapter 7th, 15: in Jeremiah, chapter 10th, these is extant only one verse. From these fragments, compared with the Hebrew, it plainly appears, that the difference between that language and the Chaldaic is scarce equal to that between the Doric and Ionic dialects of the Greek.

Whatever might have been the form of the most ancient Chaldaic letters, it is generally known that the beautiful square characters, in which the Hebrew Scriptures began to be written after the age of Ezra, were current among them at an era prior to the Babylonish captivity. Those elegant characters were probably the invention of the Chaldean academies, which were established in various parts of that extensive and fertile country.

59 Chaldean differs little from the Hebrew.

The Chaldean declensions and conjugations differ so little from the Hebrew modifications, that it would be almost superfluous to dwell upon them in this section. The most effectual way to acquire an idea of the ancient Chaldaic, is to decompound the names confessedly of that dialect, which occur in many places of Scripture. By this method of proceeding, its beautiful structure and expressive energy will be readily comprehended even by the most illiterate classes of our readers. At the same time, we must observe, that the Chaldaic and ancient Syriac bore so near a resemblance to each other, that they have generally been classed under one head.

The first Chaldaic word that occurs in the Old Testament is *bara* " *creavit*." This word has all along been assigned to the language under consideration; for what reason, we confess we are not able to discover. The greatest part of the Hebrew tongue is now lost. The words *bar*, " a son," and *bara* " *creavit*," (rather *filiavit*), may probably be of that number. Another Scripture word which is often quoted, and always ascribed either to the Syriac or Chaldaic, is *igar* or *jegar sahadutha*,

sahadutha, which signifies "a mountain of witnesses." Every body knows, that when Jacob and Laban made their compact, the latter denominated the heap of stones reared upon that occasion in this manner; while the former called it *Galeed*, as we now write and pronounce it. This pronunciation, however, does not appear to us altogether genuine. The word is probably compounded of פל, *gal*, *cumulus*, "a heap," and ער, *chad*, *æternitas*, *seculum*, "eternity, an age:" so that פלער, *galchad*, or *galaad* as it came to be written afterwards, signified an "everlasting heap." Laban then had respect to the end for which the monument was erected; but Jacob alluded to its duration. It appears, however, upon this and every other occasion, when Chaldaic words are mentioned, that א, *a*, was a favourite letter both with the Syrians and Chaldeans. We may likewise observe, that the same people always changed the Hebrew ש, *shin*, into ת, *thau*, in order to avoid the serpentine sound of that consonant.

60
Its proper names pure Hebrew.

The Chaldaic names of gods, men, places, &c. which occur in Scripture, appear to be no other than Hebrew polished and improved. *Bel*, *Belus* in Latin, is evidently בעל, *Baal*, or we think rather ב-על, *Bechel*. The Phœnicians, and sometimes the Hebrews, used it to signify *the most high*. The Chaldeans used their word *Bel* for the same purpose; and because this word originally imported the *High One*, they dignified their first monarch with that name. They denominated their capital city *Ba-Bel*, which imports the *temple of Bel*, and afterwards *Babylon*, which intimates *the abode or dwelling of our lord the sun*. *Nebo* was a name of the moon among the Babylonians, derived from the Hebrew נבא, *nabah*, *vaticinari*, "to prophecy." *Azer* was the planet Mars, from אער, *Azer* or *Ezur*, *accinxit*, "to gird," alluding to the girding on of arms. *Ahad* was an Assyrian name of the sun*, a word deduced from the Hebrew אער, *ahad*, *unus*, "one." *Netzar* was the name of an Arabian idol†, which often occurs in the composition of Babylonian names. In Arabic it signifies an *eagle*: we think, however, that the word is the Hebrew נער, *natzar*, *custodivit*, *servavit*, "to keep, to preserve." To these names of deities many more might be added, which the nature of our design will not allow us to mention.

Almost all the Chaldean proper names which occur either in sacred or profane history are evidently of Hebrew original, or cognate with that language. We shall subjoin a few examples: *Nabonassar* is evidently compounded of *Nabo* and *nazur*, both Hebrew words. *Nabopollazar* is made up of *Nabo-Pul*, the same with *Bel*, and *Azer* or *Azor*, above explained. *Belesis* is made up of *Bel* and אשא, *Esha*, "fire." Nebuchadnezzar, Belshazzar, Beltishazzar, Neriglissar, Nebuzaradan, Rabmag, Rabsaris, Nergal Sharezer, Rabshakeh, Ezarhaddon, Merodach, Evil Merodach, and numberless others, are so manifestly reducible to Hebrew vocables, when decompounded, that the oriental scholar will readily distinguish them.

Names of places in the Chaldaic are likewise so nearly Hebrew, that nothing but the dialectical tone separates them. Thus *Ur* of the Chaldeans is actually אור, *light*, that city being sacred to the sun: *Sippora* is plainly the Hebrew word *Zipporah*; *Carchemish*, a city on the Euphrates, is evidently compounded of *Kir* or *Kar*, "a city," and *Chemosh*, a name of the sun. In short, every Chaldean or old Syrian word now extant, without any difficulty, bewray their Hebrew original. As for their dialectical differences, these we remit to the Chaldaic grammars and lexicons.

61
Phœnician language derived from the Hebrew.

We now proceed to the consideration of the Phœnician language, which is known to have been that of the ancient Canaanites. That this was one of the original dialects, and consequently a cognate of the Hebrew, is universally acknowledged. Instead therefore of endeavouring to prove this position, we may refer our readers to the works of the learned Mr Bochart, where that author has in a manner demonstrated this point, by deriving almost all the names of the Phœnician colonies from the Hebrew, upon the supposition that the dialect of those people was closely connected with that tongue. St Augustine, *de Civitate Dei*, has observed, that even in his time many of the vulgar in the neighbourhood of Carthage and Hippo spoke a dialect of the old Punic which nearly resembled the Hebrew. Procopius, *de bello Goth.* informs us, that there existed even in his days in Africa a pillar with this inscription in Hebrew, "We flee from the face of Joshua the robber, the son of Nun." The names of all the ancient cities built by the Carthaginians on the coast of Africa are easily reducible to a Hebrew original. The Carthaginian names of persons mentioned in the Greek and Latin History, such as Himilco, Hamilcar, Asdrubal, Hannibal, Hanno, Dido, Anna or Hannah, Sophonisba, Gisgo, Maharbal, Adherbal, &c. all breathe a Hebrew extraction.

The Greeks borrowed a great part of their religious worship from the people of whose language we are treating; of consequence, the names of most of their gods are Phœnician. Almost every one of these is actually Hebrew, as might easily be shown. The names of persons and places mentioned in the fragments of Sanchoniathon, preserved by Eusebius, are all of Hebrew complexion. The names mentioned in the Hebrew scriptures of places which belonged to the Canaanites prior to the invasion of the Israelites under Joshua, are as much Hebrew as those which were afterwards substituted in their stead. The Punic scene in Plautus has been analysed by Bochart and several other learned men, by whom the language has been clearly proved to be deduced from the Hebrew, with some dialectical variations.

The island of Melita (now Malta) was inhabited by a colony of Phœnicians many ages before the Moors took possession of it. Among the vulgar of that island many Punic vocables are current to this day, all which may be readily traced up to the Hebrew fountain. To these we may add many inscriptions on stones, coins, medals, &c. which are certainly Phœnician, and as certainly of Hebrew extraction. We have thrown together these few hints without pursuing them to any great length, as we deemed it unnecessary to dwell long on a point so hackneyed and so generally acknowledged.

62
Origin of the Ethiopians.

Before we proceed to treat of the ancient language of the Ethiopians, we find ourselves obliged to hazard a few strictures on the origin of that ancient nation. If we can once settle that single point, the discovery will open an avenue to their primitive dialect, the article about which we are chiefly concerned in the present discussion.

In our Section concerning the Hebrew language, we were led often to mention the patriarch Cush the eldest son of Ham. The posterity of this family chief, under his son Nimrod, possessed themselves of Shinar, afterwards denominated *Chaldea*. These were probably the Arabians whose kings (according to Eusebius, Africanus, and other ancient chronologers) reigned in Babylon during several successive generations. Those were the Cushim or Cushites, whom the learned Mr Bryant has conducted over a great part of the world, and to whose industry and ingenuity he has ascribed almost all the inventions, arts, sciences, laws, policy, religions, &c. which distinguished mankind in the earliest ages.

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* Macrob. lib. i. c. 23.

† Pococke Specim. Hist. Arab.

In process of time, the posterity of Chasid or Chesed, called *Chasdim* or *Chasidim*, in the east, and *Chaldeans* in the west, drove out the Cushim, and seized upon their country. The Cushim retired westward, and spread themselves over that part of Arabia situated towards the south-east. They probably extended themselves over all the eastern part of that peninsula, from the sea to the wilderness between Arabia and Syria. Those were the Ethiopians mentioned in Scripture by a very unpardonable inadvertency of our translators. These, then, we think, were the primitive Cushim.

Josephus informs us †, that all the Asiatics called the Ethiopians of Africa by the name of *Cushim*. This denomination was not given them without good reason: it imports at least, that they deemed them the descendants of Cush; it being the constant practice of the orientals in the early ages to denominate nations and tribes from the name of their great patriarch or founder. The name *Cushim* must then have been given to the Ethiopians, from a persuasion that they were the progeny of the son of Ham who bore that name. By what route soever the Cushim penetrated into that region of Africa which was called by that name, it may be taken for granted that they were the descendants of Cush above mentioned.

† *Antiq. Jud.* lib. i. c. 7.

It has been observed above, that the posterity of Cush possessed the country of Shinar or Chaldea at a very early period, but were expelled by the Chasidim or Chaldeans. Upon this catastrophe, or perhaps somewhat later, a colony from the fugitive Cushim transported themselves from the south and south-east coast of Arabia over the sea which lies between that country and Ethiopia. However imperfect the art of navigation might be in that age, the distance was so small that they might easily enough make a voyage cross that narrow sea in open boats, or perhaps in canoes. However that may have been, it cannot be doubted that the tribes on both sides of that branch of the sea were kindred nations.

63
Their language originally Chaldean.

If, then, both the northern and southern Cushim sprung from the same stock, there can be no doubt that both spoke the same language. The language of the Babylonian Cushim was Chaldaic, and of consequence that of the Ethiopian Cushim was the same. We may therefore rest assured, that whatever changes the Ethiopian dialect may have undergone in the course of 3000 years, it was originally either Chaldaic, or at least a branch of that language. Scaliger informs us, that the Ethiopians call themselves Chaldeans; and that, says, he not without reason, because of those many sacred and profane books which are extant among them, the most elegant and most beautiful are written in a style near that of the Chaldean or Assyrian. Marianus Victorius, who was the first that reduced the Ethiopic tongue to the rules of grammar, tells us, in his *Proœmium*, "that the Ethiopians call their tongue Chaldaic; that it springs from the Babylonian; and is very like the Hebrew, Syriac, and Arabic: At the same time (he concludes), that this language may be easily learned by those who are masters of the Hebrew." The learned Bochart, and Bishop Walton in his *Proleg.* are clearly of the same opinion.

The vulgar letters of the Ethiopians, according to Diodorus Siculus, were the same with the sacred †† characters of the Egyptians (D). From this account, if the Sicilian may be trusted, the sacred letters of these people, concerning which so many wise conjectures have been formed, were actually Chaldaic. To carry on this investigation a little farther, we may observe, that Sir William Jones seems to have proved, by very plausible arguments, that the Sanscrit characters were deduced from the Chaldaic. This circumstance affords a presumption that the Ethiopian Cushim were likewise concerned with the Egyptians; who, as is remarked in the Section concerning the *Sanscrit*, probably introduced the religion of the Brahmans into Hindostan. This is advanced as a conjecture only; and yet when we consider the affinity between the Egyptian and Gentoo religions, we are strongly inclined to hope that this surmise may one day be verified by undeniable facts.

†† Lib. iii. p. 101. *Steph.*

64
Ancient intercourse between the Ethiopians and Egyptians.

The original Ethiopians were a people highly civilized; their laws, their institutions, and especially their religion, were celebrated far and wide. Homer talks in raptures of the piety of the Ethiopians, and sends his gods every now and then to revel 12 days with that devout people. The Sicilian adduces a number of very specious arguments to prove that these two nations had sprung from the same stock. He mentions a similarity of features, of manners, of customs, of laws, of letters, of the fabrication of statues, of religion, as evidences of the relation between those two neighbouring nations. There was, every body knows, a communion, as to sacred rites, between the two countries. The Egyptians sent annually a deputation of their priests, furnished with the portable statues of their gods, to visit the fanes of the devout Ethiopians. Upon this occasion, a solemn religious banquet was prepared, which lasted 12 days, and of which the priests of both nations were partakers. It was, we imagine, a kind of sacramental institution, by which both parties publicly avouched their agreement in the ceremonies of their religion respectively. These observations plainly show, that the most ancient Ethiopians were a people highly civilized; indeed so much, that the Egyptians were at one time contented to be their scholars. The tone of their language was certainly the same with that of the Chaldeans or Arabian Cushim, from whom they are descended. We know not whether there are any books in the ancient Ethiopic now extant; so that it is not easy to produce instances of its coincidence with the Chaldaic. Diogenes Laertius ‡ informs us, that Thrasyllus, in his catalogue

‡ Lib. ix. p. 461. *Casaub.*

(D) We find the same observation confirmed by Heliodorus (*Ethiop.* lib. x. p. 476.). "The royal letters of the Ethiopians (says he) were the sacred characters of the Egyptians." Cassiodorus likewise assures us, "That the letters inscribed upon the Egyptian obelisks were Chaldean." See Sect. *Sanscrit*.

talogue of the books composed by Democritus, mentions one, περι των εν Μεροη ιερων γραμματων, *concerning the sacred letters in the island of Meroe* (E); and another concerning the sacred letters in Babylon. Had these books survived the ravages of time, they would in this age of research and curiosity have determined not only the point under our consideration, but the affinity of sacred rites among the Chaldeans, Ethiopians, and Egyptians.

65 Modern Ethiopic tongues.

We have now shown that the Ethiopians were a colony of Cushites; that the Cushites were originally sovereigns of Shinar or Chaldea, and consequently spoke either Chaldaic, or a dialect of that tongue; that their colonists must have used the same language; that the ancient Ethiopians were a people highly polished, and celebrated in the most early ages on account of their virtue and piety. It has likewise appeared that the common letters of that people were the sacred characters of the Egyptians, These letters, we imagine, were the Cuphite; for which see the section on the *Arabic*. When they were discarded, and the modern substituted in their room, cannot be determined; nor is it, we apprehend, a matter of much importance. We shall therefore drop that part of the subject, and refer our curious and inquisitive readers to the very learned Job Ludolf's (F) excellent grammar and dictionary of the Abyssinian or Geez tongue, where they will find every thing worth knowing on that subject. We shall endeavour to gratify our readers with a very brief account of the modern Ethiopic or Abyssinian tongue; for which both they and we will be obliged to James Bruce, Esq. that learned, indefatigable, and adventurous traveller; who, by his observations on that country, which he made in person, often at the hazard of his life, has discovered, as it were, a new world both to Europe and Asia.

The most ancient language of Ethiopia, which we shall now call *Abyssinia* (its modern name), according to that gentleman, was the *Geez*, which was spoken by the ancient Cushite shepherds. This, we should think, approaches nearest to the old Chaldaic. Upon a revolution in that country, the court resided many years in the province of Amhara, where the people spoke a different language, or at least a very different dialect of the same language. During this interval, the *Geez*, or language of the shepherds, was dropt, and retained only in writing, and as a dead language: the sacred Scriptures being in that tongue only saved it from going into disuse. This tongue is exceedingly harsh and unharmonious. It is full of these two letters D and T, in which an accent is put that nearly resembles stammering. Considering the small extent of sea that divides this country from Arabia, we need not wonder that it has great affinity with the Arabic. It is not difficult to be acquired by those who understand any other of the oriental languages; and as the roots of many Hebrew words are only to be found here, it seems to be absolutely necessary to all those who wish to obtain a critical skill in that language.

66 Ethiopic alphabet.

The Ethiopic alphabet consists of 26 letters, each of which, by a *virgula* or point annexed, varies its sound in such a manner as that those 26 form as it were 62 distinct letters. At first they had but 25 of these original letters, the Latin P being wanting: so that they were obliged to substitute another letter in its place. *Paulus*, for example, they call *Taulus*, *Aulus*, or *Caulus*: *Petros*, they pronounced *Ketros*. At last they substituted T, and added this to the end of their alphabet; giving it the force of P, though it was really a repetition of a character rather than the invention of a new one. Besides these, there are 20 others of the nature of diphthongs; but some of them are probably not of the same antiquity with the letters of the alphabet, but have been invented in later times by the scribes for convenience.

The Amharic, during the long banishment of the royal family in Shoa, became the language of the court, and seven new characters were of necessity added to answer the pronunciation of this new language; but no book was ever written in any other language than *Geez*. There is an old law in the country, handed down by tradition, that whoever shall attempt to translate the Holy Scripture into Amharic or any other language, his throat shall be cut after the manner in which they kill sheep, his family sold to slavery, and their houses razed to the ground.

Before we leave this subject, we may observe, that all the ancients, both poets and historians, talk of a double race of Ethiopians; one in India, and another in Africa. What may have given rise to this opinion it is not easy to discover. Perhaps the swarthy complexion of both people may have led them to this sentiment. Eusebius indeed informs us ‡, that "a numerous colony of people emigrated from the banks of the Indus, and, crossing the ocean, fixed their residence in the country now called Ethiopia." For our part, we are rather inclined to believe, that the original Ethiopians transported themselves into India, and there perhaps co-operated with the Egyptians in digging the excavations and framing the statues, some of which are still to be seen in that country, and which we have mentioned in another Section. The Greeks called those people Αιθιοπες, *Æthiopes*, we believe, from their sun-burnt countenance; but indeed they were very little acquainted either with the country or its inhabitants.

‡ *Chron.* p. 12.

67 Ancient language of Egypt a sister dialect of Hebrew.

The most ancient name of Egypt was *Mizraim*, of consequence the Arabians still call it *Mesri*. It was likewise distinguished by other names, such as *Oceana*, *Aeria*, &c. It appears from the sacred historian, that it was inhabited by the descendants of Mizraim the second son of Ham. Mizraim had several sons, who, according to the Scripture account, settled respectively in that country. If we trust to the sacred records, there will be little difficulty in ascertaining the language of the Mizraim. It will appear to be one of the sister dialects of the Hebrew, Phœnician, Arabic, Chaldaic, &c.; and this, to us, appears to be the fact. But the origin of that people, their language, religion, laws, and institutions, have been so warped and confounded, both by their own historians and those of other countries, that one is scarce able to determine what to believe or what

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(E) Where the capital of Ethiopia was situated.

(F) A very learned German, who published a grammar and dictionary of the Geez in folio.

to reject. Herodotus, Diodorus Siculus, Strabo, Ptolemy, and most other ancient geographers and historians, are universally agreed, that Egypt, at least that part of it called *Delta*, was overflown by the sea, and consequently uninhabitable for many centuries after the dispersion of mankind. When we consider the low situation of the Delta, and the violent current of the tide from the coast of Phœnicia and Palestine towards that shore, we would be almost tempted to adopt this hypothesis; but the sacred records avouch the contrary. According to them, we find Egypt a populous, rich, and flourishing kingdom, as early as the age of Abraham. Had the Lower Egypt been a pool of stagnating water at any time after the general deluge, we think it could not have been drained, cleared, cultivated, and stocked with inhabitants, so early as the days of Abraham.

Diodorus Siculus, however, is positive that the Egyptians ‡ were a colony of Ethiopians; and this he endeavours to prove by the similarity of features, customs, laws, religious ceremonies, &c. between the two nations. That there was a constant intercourse of good offices between these two branches of the Hamites, cannot be questioned; and that they nearly resembled each other in many respects, is too evident to admit of contradiction. The excavations, originally dug out of the solid rocks of porphyry and marble, in which the natives resided before the plains were drained, have been observed by a most judicious traveller (G) a very few years ago. At the same time, the most accurate and judicious travellers (H) who have visited that region in modern times, are generally of opinion that the land has gained nothing on the sea since the period when Herodotus wrote his description of that country; from which circumstances we may be led to conclude, that the idea of the inundation of the Delta is not founded in fact.

‡ Lib. xiii. *passim.*

But even admitting that the Egyptian Delta has acquired nothing from the sea since the age of Herodotus to the present, it certainly does not follow that the region in question was never overflown by that element; since there are in many parts of the globe, large tracts of land, certainly once covered with sea, which have continued to this day in the very same situation in which they were 2000 years ago. We leave the decision of this point to the judgment of our readers.

We have already hinted our opinion of the nature of the Egyptian language; but because Egypt is generally thought to have been the native land of hieroglyphics, and because many are of opinion that hieroglyphical characters were prior to alphabetical, we shall hazard a few conjectures with respect to that species of writing.

68
Egyptian hieroglyphics.

The end of speech, in general, is to enable men to communicate their thoughts and conceptions one to another when present; the use of writing is to perform the same office when people are at so great a distance that vocal sounds cannot mutually reach them. Hieroglyphics are said to have been invented to supply this defect. The most ancient languages were everywhere full of tropes and figures borrowed from sensible objects. As in that stage of society men have not learned to abstract and generalize, all their ideas are borrowed from such objects as most forcibly strike their senses. This circumstance would naturally suggest to savages the idea of conveying their sentiments to each other, when absent, by delineations of corporeal objects. Thus, if a savage asked a loan of his friend's horse, he might find means to have conveyed to him the figure of that animal; and so of others. This was the very lowest species of ideal communication, and has been styled *picture-writing*.

Necessity would soon impel our savage correspondents to fabricate a method more extensively useful, which would likewise be suggested by the constant use of the metaphorical mode of speech. Some savage leader, more sagacious than the vulgar herd, would observe that certain sensible objects were fitted, according to the rules of analogy, to represent certain human passions, and even some abstract ideas; and this would be readily enough adopted by the herd as a new improvement. In this case a *horn* might be the emblem of *power*, a *sword* of *bravery*, a *lion* of *fury*, a *fox* of *cunning*, a *serpent* of *malice*, &c. By and by artificial signs might be contrived to express such ideas as could not readily be denoted by bodily objects. This might be called *symbolical writing*. Such was the foundation of the Chinese characters; and hence that prodigious number of letters of which the written language of that people is composed. Farther they could not proceed, notwithstanding their boasted inventive powers; and farther, we believe, no nation ever did proceed, who had once upon a time no other characters but hieroglyphical. The Mexicans had arrived at the very lowest stage of hieroglyphical writing, but had not taken one step towards alphabetical. The Hurons employ hieroglyphical symbols, but never entertained a single idea of alphabetical. Hieroglyphical characters are the images of objects conveyed to the mind by the organs of vision; alphabetic are arbitrary artificial marks of sound, accommodated by compact to convey to the mind the ideas of objects by the organs of hearing. In a word, we think that there is not the least analogy between these two species to conduct from the one to the other: we are therefore of opinion, that hieroglyphical characters were never the vulgar channels of ideal conveyance among civilized people.

69
Were never in vulgar use;

We know that in this point we differ from many learned, judicious, and ingenious writers; some of whom have taken much pains to investigate the intermediate stages through which the fabricators of characters must have passed in their progress from hieroglyphical to alphabetical writing. These writers have adopted a plan analogous to Bishop Wilkins's project of an artificial language. In this theory, we own, we are led to suspect that they supposed all mankind were once upon a time *savages*, and were left to hammer out words, as well as characters, by necessity, ingenuity, experience, practice, &c. For our part, we have endeavoured to prove, in our section on the Hebrew language, that alphabetical writing was an antediluvian invention; and we now lay it down as our opinion, that among all those nations which settled near the centre of civilization,

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(G) See Mr Bruce's Travels, vol. i.

(H) Mr Bruce, Dr Shaw, Bishop Pococke, Savary, Volney, &c.

tion, hieroglyphics were, comparatively, a modern fabrication.

The Orientals are, at this day, extravagantly devoted to allegory and fiction. Plain unadorned truth has with them no charms. Hence that extravagant medley of fables and romance with which all antiquity is replete, and by which all ancient history is disguised and corrupted. Every doctrine of religion, every precept of morality, was tendered to mankind in parables and proverbs. Hence, says the Scripture, to understand a proverb, the words of the wise, and their dark sayings. The eastern sages involved their maxims in this enigmatical dress for several reasons: to fix the attention of their disciples; to assist their memory; to gratify their allegorical taste; to sharpen their wit and exercise their judgment; and sometimes perhaps to display their own acuteness, ingenuity, and invention.

It was among the ancients an universal opinion, that the most sacred arcana of religion, morality, and the sublime sciences, were not to be communicated to *the uninitiated rabble*. For this reason every thing sacred was involved in allegorical darkness.

70 But employed to conceal sacred doctrines from the uninitiated;

Here, then, we ought to look for the origin of hieroglyphical or picture writing among the civilized nations of the east, They did not employ that species of writing because they were ignorant of alphabetical characters, but because they thought fit to conceal the most important heads of their doctrines under hieroglyphical figures. The Egyptian priests were most celebrated for their skill in devising those emblematical representations; but other nations likewise employed them. We learn from the fragments of Berosus the Chaldean historian, preserved by Syncellus and Alexander Polyhistor, that the walls of the temple of Belus at Babylon were covered all over with those emblematical paintings. These characters were called ἱερα, because they were chiefly employed to represent sacred objects; and γλυφικα, because they were originally carved or engraved. Their name points to their original use. Instead of pursuing these observations, which the nature of our design will not permit, we must refer our readers to Herodotus, lib. ii. Diodorus Sic. lib. i. Strabo, lib. xvii. Plut. Isis et Osiris; and among the Christian fathers to Clem. Alex. Euseb. Præp. Evang.; but chiefly to Horapollo's Hieroglyphica.

71 and posterior in time to alphabetical characters.

From this deduction we would conclude, that this species of writing was an adventitious mode in Egypt, peculiar to the priests, and employed chiefly to exhibit things sacred; and that among all civilized people it did not supersede the use of alphabetical characters, nor did the use of the latter originate from the former. When alphabetical letters were invented, if indeed they were a human invention, they were antecedent to the other in use and extent. The Egyptian priests alone knew the true import of those sacred symbols; and communicated that knowledge first to their own children from generation to generation, then to the initiated, and last of all to the grandees of the nation, all of whom were indeed initiated. The hieroglyphics of Egypt were not then the symbols of any sacred occult language; but signs invented by the priests, and prophets or wise men, in order to represent their deities, the attributes and perfections of their deities, and the mysterious arcana of their religion, and many other circumstances relating to objects of importance, which were deemed either too sacred or too important to be imparted to the vulgar.

The Egyptians ascribed the invention of letters to a person whom they called *Thoth* *, *Theuth*, or *Thyoth*; the Greeks Ἑρμης; and the Romans *Mercurius*. Plato † calls him a god, or a godlike man; Diodorus ‡ makes him privy counsellor to Osiris; Sanchoniathon ap. Euseb. § connects him with the Phœnician Cronus or Saturn. To this Mercury the Egyptians ascribe the invention of all the arts and sciences. He was probably some very eminent inventive genius, who flourished during the first ages of the Egyptian monarchy, and who perhaps taught the rude savages the art of writing.

72 Two kinds of alphabetical characters in Egypt.

According to Diodorus Siculus, the Egyptians had two kinds of letters *; the one sacred, the other common: the former the priests taught their own children, the latter all learned promiscuously. In the sacred characters the rites and ceremonies of their religion were couched; the other was accommodated to the ordinary business of life. Clem. Alexand. mentions three different styles of writing employed by the Egyptians †. "The pupils, who were instructed by the Egyptians, first learned the order and arrangement of the Egyptian letters, which is called *epistolography*, that is, the manner of writing letters; next, the sacred character, which the sacred scribes employed; lastly, the hieroglyphic character, one part of which is expressed by the first elements, and is called *Cyriologic*, that is, *capital*, and the other *symbolic*. Of the symbolic kind, one part explains properly by imitation; and the other is written tropically, that is, in tropes and figures; and a third by certain enigmatical expressions. Accordingly, when we intend to write the word *sun*, we describe a circle; and when the moon, the figure of that planet appearing horned, conformable to the appearance of that luminary after the change." In this passage we have an excellent description of the three different modes of writing used by the Egyptians; the common, the sacred, and the hieroglyphic. The last he describes according to its three divisions, in exact conformity to our preceding observations.

73 The sacred letters and language of Egypt Chaldaic.

By the description above translated, it plainly appears, that the sacred character of the Egyptians was entirely different from the hieroglyphic; and by this consideration we are in a good measure justified, in supposing, as we have done all along, that the sacred letters of the Egyptians were actually the Chaldaic. The inscriptions on the obelisks mentioned by Cassiodorus, so often quoted, were certainly engraved in the sacred character; and the character in which they were drawn was that above mentioned. If the sacred letters were Chaldaic, the sacred language was probably the same.

The Egyptians pretended, that the Babylonians derived the knowledge of the arts and sciences from them; while, on the other hand, the Babylonians maintained, that the former had been tutored by them. The fact is, they both spoke the same language; used the same religious rites; had applied with equal success to astrology, astronomy, geometry, arithmetic, and the other sciences; of course a rivalship had arisen between the two nations, which laid the foundation of those opposite pretensions.

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* *Euseb. Prop. Ev.*

† *Phædrus.*

‡ Lib. i.

§ *Prep. Ev.*

* Lib. i.

† *Strom.* lib. v.

The most faithful specimen of the vulgar language of the Egyptians, is, we believe, still preserved in the Coptic, which, however, is so replete with Grecisms, that it must be difficult to trace it out.

Under the Ptolemies, the Greek was the language of the court, and consequently must have diffused itself over all the country. Hence, we believe, two-thirds of the Coptic are Greek words, diversified by their terminations, declensions, and conjugations only. To be convinced of the truth of this, our learned and curious readers need only consult Christian Scholtz's Egyptian and Coptic grammar and dictionary, corrected and published by Godfred Woide, Oxford, 1788.

74
The Egyptian and Phœnician languages the same.

The Egyptians and Phœnicians were in a manner cousin-germans, and consequently must have spoken the same language; that is, one of the sister dialects of the Hebrew, Chaldean, Arabian, Cushite, &c.—This is not a mere conjecture; it may be realized by almost numberless examples. It is true, that when Joseph's brethren went down to Egypt, and that ruler deigned to converse with them, they could not understand the Egyptian idiom which he spoke; nor would he, had he been actually an Egyptian, have understood them without an interpreter. The only conclusion from this circumstance is, that by this time the Egyptian had deviated considerably from the original language of mankind. The Irish and Welch, every body knows, are only different dialects of the Celtic tongue; and yet experience proves, that a native of Ireland and another of Wales cannot well comprehend each other's language, nor converse intelligibly without an interpreter. The Erse, spoken in the Highlands of Scotland, and the Irish, are known to be both branches of the old Celtic; yet a Scotch Highlander and an Irishman can hardly understand each other's speech. By a parity of reason, a Hebrew and an Egyptian might, in the age of Joseph, speak only different dialects of the same original tongue, and yet find it difficult to understand one another. The fact seems to be, the Hebrew dialect had been in a manner stationary, from the migration of Abraham to that period; whereas the Egyptian, being spoken by a powerful, civilized, and highly cultivated people, must have received many improvements, perhaps additions, in the course of near two centuries.

75
The vulgar letters of Egypt nearly the same with the Hebrew or Phœnician.

The descendants of Canaan and of Mizraim were strictly connected in their religious ceremonies: they worshipped the same objects, namely, the *Host of Heaven;* they mourned *Osiris* and *Adonis* in concert; they carried on a joint commerce, and, we think, spoke the same language: we may, therefore conclude, that their vulgar letters were nearly the same, both in form, disposition, and number. Their original number was probably 16, viz. five vowels, six mutes, simple and middle, four liquids, and the solitary *σ*.—With these, it is likely, was joined a mark of aspiration, or an *h*, such as we have in the Roman alphabet, and find on some Greek monuments. Cadmus was originally an Egyptian; that leader brought a new set of letters into Greece. These are generally deemed to be Phœnician. They were nearly the same with the ancient Pelasgic, as will be shown in the section of the *Greek language*. The latter, we think, were from Egypt, and consequently the former must have been from the same quarter. Danaus, Perseus, Lelex, &c. were of Egyptian extraction: they too adopted the Cadmean characters, without substituting any of their own.

The Jonim or Ionians, emigrated from Gaza, a colony of Egyptians; and their letters are known to have differed very little from those of Cadmus and the Pelasgi. The conclusion, therefore is, that the vulgar Egyptian letters were the same with the Phœnician.

We are abundantly sensible that there are found upon Egyptian monuments characters altogether different from those we have been describing. At what time, by what people, and to what language, these letters belonged, we will not pretend to determine. The Ethiopians, the Chaldeans, the Persians, the Greeks, the Romans, the Saracens, have, at different times, been sovereigns of that unhappy country. Perhaps other nations, whose memory is now buried in oblivion, may have erected monuments, and covered them with inscriptions composed of words taken from different languages, perhaps, upon some occasions, whimsically devised, with a view to perplex the curious antiquaries of future ages. Some of these are composed of hieroglyphics intermingled with alphabetical characters, artificially deranged, in order to render them unintelligible. These we do not pretend to develope; because the most inquisitive and sagacious antiquaries are not yet agreed as to their purport and signification.

76
Egyptian names of Hebrew original.

We shall now go on to show, that most part of the names of persons and places, &c. which have been conveyed down to us, may, in general, be reduced to a Hebrew, Phœnician, Syrian, or Chaldean original. As the first of these languages is most generally known, we shall employ it as our arch-type or standard, beginning with those terms which occur in Scripture.

The word *Pharaoh*, the title of the *melech* or king of Egypt, is, we think, compounded of two terms, which plainly discover a Hebrew original. According to an oriental tradition, the first who assumed this title was the sovereign of the *royal shepherds;* a race of people from Arabia and Phœnicia. They conquered Egypt at an early period, and kept possession of it for several centuries. They gloried in the title ὑκσοι, or ὑκουσοι, which according to Josephus *contra Apion*, signifies "royal shepherds." The word *Pharaoh* seems to be compounded of פך *Phar*, "a bullock,' and דעת, *Rachah*, "to feed;" hence פרעת, *Pharachah*, as we think it ought to be written. The name given to Joseph is evidently of kin with the Hebrew; for *zaphnath* differs very little from the Hebrew verb *tzaphan*, which signifies "to hide, to keep secret;" *Pancuh* or *Phaneah*, signifies much the same with the Hebrew *Phanah*, aspexit: so that the name actually intimates *one* who sees hidden things; which was certainly the very idea the prince intended to convey by giving him that name.

Potiphar, or *Potipherah*, the name of Joseph's father-in-law, has likewise a dialectical affinity with the Hebrew idiom. In that language *Patah* signifies "to open, to explain," which was one part of the sacerdotal office; and *Phar* imports "a bullock." Potiphar was then priest of the bullock, that is, the ox, *apis*, sacred to the *sun* (I). This person was priest or *prince of On*, which, according to Cyrillus on Hosea, was an Egyptian name of that luminary. The Hebrew word *hon* or *chon* signifies " power, wealth, sufficiency ;" a very proper epithet for the *sun*, who was thought to bestow those blessings. The name of Joseph's wife was *Asenath* or *Asnath*, compounded of *Ishah*, " a woman," and *Naith* or *Neit*, an Egyptian name of Minerva, " a votary of Minerva."

77 and significant in that language.

Almost all the names of cities belonging to Egypt which are mentioned in Scripture are evidently Hebrew. To be satisfied as to this position, our curious readers may consult Jamieson's *Spicilegia*, an excellent book very little known. The names of most of the Egyptian deities are significant in the Hebrew tongue; and in that dialect the names appear to have been imposed with great judgment and propriety, plainly indicating some office assigned them, or pointing to some peculiar attribute. We shall produce a few instances.

Osiris was the great divinity of Egypt ; he was certainly the *sun*. The Egyptians gave their deities a variety of names in allusion to their various offices and attributes. Jablonski has in a manner wearied himself with tracing the signification of this name. In Hebrew we have *Oshir*, " to grow rich, to be enriched." The sun may be called the great enricher of nature, and therefore might properly be called by a name alluding to that quality. *Isis* was both the moon and the earth. *Ishah* is the Hebrew word for *woman*, and Horapollo assigns this very derivation. *Anubis* was one of the names of Mercury among the Egyptians : He was always figured with the head of a *dog*. He accompanied *Isis* in her peregrinations in quest of Osiris, and frighted away the wild beasts from attacking the princess. In Hebrew, *Nubah* signifies " to bark." Here the analogy, we think, is evident. Many Egyptian names begin with *Can*, such as *Canobus*, *Canopus*, &c. The Hebrew word *Cahen* or *Cohen*, Syr. *Con* or *Chon*, intimates both a prince and a priest. *Ob* or *Aub*, in Hebrew, imports " a bottle, a flaggon," any thing round and prominent like the human belly. In the language of Egypt it was often applied to the sun, in allusion to his rotundity. In the temple of *Jupiter Ammon or Amon*, in the desert of Libya, there was a statue of the god representing the *navel* of the human body, which was probably framed in allusion to this fancy. Hence the Pythoness, or people who, according to the Scripture, had familiar spirits, were said to prophecy by the inspiration of *Ob*, as the Delphic priestess did by that of Apollo. Again, many Egyptian names end with *siris*, as Calasiris, Termosiris. This termination is no doubt a cognate of the Hebrew and Chaldean *sar* or *zar*, signifying " a prince, or grandee, &c." The river Nile in the Ethiopic dialect is called *Siris* ; that is, we believe, the *king of rivers*. The same flood seems to derive the name by which it is generally known, from the Hebrew *nehel*, " a valley, or torrent running down a valley." The same river was often called *Oceanus*, a word composed of *og*, or *oc*, or *och*, which signifies " a king, a leader," and the Hebrew *oin*, " a fountain ;" so that the word imports the *king of fountains*. The Hebrews always denominated the land of Egypt the land of Mizraim ; the Egyptians themselves, in later times, seemed to have called it Αιγυπτος, *Ægyptus*, " Egypt," which some think is compounded of *Ai*, Hebrew, " an island, a country, a province," and *Copt* or *Cupt*, " a famous city in that country."

From this specimen, we hope it will appear that the Egyptian language in the more early ages was one of those dialects into which that of the descendants of the postdiluvian patriarchs was divided, and perhaps subdivided, a few centuries after the deluge. Among all those, we believe, such an affinity will be found, as plainly demonstrates that they originally sprung from one common stock. Here we might easily follow the Egyptian language into Greece; and there we are persuaded we might trace a vast number of Egyptian terms into that tongue, which, however, the nature of this inquiry will not permit. If our learned readers should incline to know more of the affinity of the Egyptian tongue with the others so often mentioned, they may consult Bochart's *Chanaan*, Walton's *Proleg.* Gebelin's *Monde Prim.* Jamieson's *Spicilegia*, &c.

SECT. IV. *Of the Persian Language.*

THE Persian language is divided into the ancient and modern ; the former of which is at this day very imperfectly known, the latter is at present one of the most expressive, and at the same time one of the most highly polished, in the world. We shall, in treating of this language, in compliance with the plan we have all along followed, begin with the ancient.

78 At the birth of Mohammed two languages prevalent in Persia.

When Mohammed was born, and ANU'SHI'RAVA'N, whom he calls the *just king*, sat on the throne of Persia, two languages were generally prevalent in that empire (K). The one was called *Deri*, and was the dialect of the court, being only a refined and elegant branch of the *Parsi*, so called from the province of which *Shiraz* is now the capital ; and that of the learned, in which most books were composed, and which had the name of *Pahlavi*, either from the heroes who spoke it in former times, or from *pahlu*, a tract of land which included some considerable cities of *Iran* : The ruder dialects of both were spoken by the rustics of several provinces ; and many of these distinct idioms were vernacular, as happens in every kingdom of considerable extent. Besides the *Parsi* and *Pahlavi*, a very ancient and abstruse tongue was known to the priests and philosophers, called the language of the *Zend*, because a book on religious and moral duties which they held sacred, and which bore that name, had been written in it ; while the *Pazend* or comment on that work was composed in *Pahlavi*, as a more popular dialect. The letters of this book were called *zend*, and the language *avesta*.

79 And a more ancient language than either known only to the priests.

The *Zend* and the old *Pahlavi* are now almost extinct in *Iran*, and very few even of the Guebres can read it ; while the *Parsi* remaining almost pure in *Shahnameh*, has

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(I) The Septuagint (Gen. xli. v. 45. and 50.) translate *On* by Ἡλιουπολις.

(K) The moderns call the empire of Persia *Iran* ; a name unknown to the ancients.

has, by the intermixture of Arabic words, and many imperceptible changes, now become a new language, exquisitely polished by a series of fine writers both in prose and verse, analogous to the different idioms gradually formed in Europe after the subversion of the Roman empire.

80 Parsi language, and

The very learned and laborious Sir William Jones is confident that the *Parsi* abounds with words from the Sanscrit, with no other change than such as may be observed in the numerous dialects of India: that very many Persian imperatives are the roots of Sanscrit verbs; and that even the moods and tenses of the Persian verb substantive, which is the model of all the rest, are deducible from the Sanscrit by an easy and clear analogy. From this he infers that the *Parsi*, like the various idiom dialects, is derived from the language of the Bramins. This conclusion, we imagine, is not altogether just, since by the same train of reasoning we may infer that the Sanscrit is derived from the *Parsi*.

The same learned gentleman adds, that the multitude of compounds in the Persian language proves that it is not of Arabic but Indian original. This is undoubtedly true; but though the *Parsi* is not of Arabic original, it does not necessarily follow that it is of Sanscrit. We might with the same propriety, and with an equal show of reason, conclude, that the Greek language is descended of the Sanscrit, because it too abounds with compounds. We may then rest assured, that neither the one nor the other argument adduced by the ingenious president proves that the *Parsi* tongue is a descendant of the Sanscrit.

81 the Pahlavi,

The gentleman so often mentioned, assures us, that the Zend bears a strong resemblance to the Sanscrit; which, however, it might do without being actually derived from it, since we believe every oriental scholar will find that all the languages from the Mediterranean to the utmost coast of Hindostan exhibit very strong signatures of a common original. The Parsi, however, not being the original dialect of Iran or Persia, we shall pursue it no farther at present, but return to give some account of the Pahlavi, which was probably the primitive language of the country. We have observed above, that the Pazend or comment on the Zend was composed in the Pahlavi for the use of the vulgar. This, according to Sir William, was a dialect of the Chaldaic; and of this assertion he exhibits the following proof.

By the nature of the Chaldean tongue, most words ended in the first long vowel, like *shemaiá*, "heaven;" and that very word, unaltered in a single letter, we find in the Pazend, together with *lailiá*, "night," *meyá*, "water," *nírá*, "fire," *matrá*, "rain," and a multitude of others, all Arabic or Hebrew, with a Chaldean termination; so *zamar*, by a beautiful metaphor from *pruning trees*, means in Hebrew to *compose verses*, and thence, by an easy transition, to *sing* them; now in Pahlavi we see the verb *zamarûniten*, "to sing," with its forms *zamaraunemi*, "I sing," and *zamzunid*, "he sang;" the verbal terminations of the Persian being added to the Chaldaic root. All these words are integral parts of the language; not adventitious like the Arabic nouns and verbals engrafted on the modern Persian.

From this reasoning it plainly appears, 1st, That Pahlavi was the ancient language of Persia; and, 2d, That the ancient Persian was a cognate dialect of the Chaldean, Hebrew, Arabic, Phœnician, &c. M. Anquetil has annexed to his translation of the *Zendavesta* two vocabularies in Zend and Pahlavi, which he found in an approved collection of *Rawayat* or *Traditional Pieces* in modern Persian. His vocabulary of the Pahlavi strongly confirms this opinion concerning the Chaldaic origin of that language. But with respect to the Zend, it abounded with vast numbers of pure Sanscrit words, to such a degree, that six or seven words in ten belonged to that language.

82 derived from Chaldaic and Sanscrit, &c.

From this deduction it would appear, that the oldest languages of Persia were Chaldaic and Sanscrit: and that when they had ceased to be vernacular, the Pahlavi and Zend were deduced from them respectively, and the Parsi either from the Zend, or immediately from the dialect of the Brahmans: but all had perhaps a mixture of Tartarian; for the best lexicographers assert, that numberless words in ancient Persian are taken from the Cimmerians. With respect to the last of these, we cannot help being of opinion, that colonies of people from the neighbourhood of Persia did transport themselves into Crim Tartary, and perhaps into Europe. These colonists brought along with them those vocables which still occur in their dialect. Emigrants from those quarters must have found their way into Scandinavia, since numberless Persian words are still current in those regions. Perhaps Odin and his followers emigrated from the neighbourhood of Media and Persia, and brought with them the dialect of the nations from whose country they had taken their departure.

83 The Zend from the same source.

With respect to the Zend, it might well be a dialect of the Sanscrit, and was probably a sacred language; and if so, concealed from the vulgar, and reserved for the offices of religion. If Zoroastres, or Zaratusht as the orientals call him, travelled into Egypt, and was initiated in the mysteries of the Egyptian religion, as some pretend he was, he might be instructed in the sacred dialect of that people by the priests under whom he studied. When that philosopher returned into Persia, and became the apostle of a new religion, he might compose the volume of his laws and religious institutions in the sacred language of his Egyptian tutors. This language then became that of the Magi, who concealed it carefully from the knowledge of the uninitiated, as the priests did in Egypt and the Brahmans in Hindostan.

In our Section on the *Sanscrit* language, we shall give a detail of a number of particulars, which to us seem to furnish a presumption that the language in question was imported from Egypt into Hindostan. We confess there are not sufficient data to improve these presumptions into absolute certainty; but we hope the time is at hand when the worthy members of the Asiatic Society will discover abundant materials to ascertain the truth of this position. We are the rather inclined to adopt this hypothesis, when we consider the character of Zoroastres in connection with that of the Egyptian Cohens and of the Indian Brahams.

If this opinion should one day appear to be well-founded, we believe the coincidence between the language of the Zend and the Sanscrit will be easily accounted for, without making the Hindoos masters of Iran or Persia, and then driving them back to the shores of the Ganges. That the nations of Turan or Scythia did actually overrun that country, and make themselves masters of a considerable part of it at different times, is vouched by the records and traditions of the Persians themselves. Upon those occasions a number of Tartarian words might be introduced into the country, and acquire a currency among the inhabitants. As the annals of ancient Persia have been long since destroyed and consigned to eternal oblivion, it is impossible to ascertain either the extent or duration of these irruptions. Indeed the nature of our design does not call for that investigation.

84
Proofs from Scripture of the origin of the Pahlavi.

In order to corroborate the cognation between the Chaldean and Pahlavi languages, we shall subjoin a few arguments derived from the Mosaic history, and the other writings of the Old Testament. These we believe will be admitted as irrefragable proofs of the position above advanced by such as admit the authenticity of those records.

Elam is always allowed to have been the progenitor of the Persians. This patriarch was the eldest son of Shem the son of Noah; and according to the Mosaic account, his posterity settled in the neighbourhood of the descendants of Ashur, Arphaxad, Lud and Aram, the other sons of Shem. The country where they settled was denominated *Elymais* †, as late as the beginning of the Christian era. This name was retained till the Saracens conquered and took possession of that country. If this was the case, as it certainly was, the Elamites or Persians spoke a dialect of the primary language, which, in the first Section, we have proved to have been the Hebrew.

When the four eastern monarchs invaded the five cities of the plain in Canaan ‡, Chedorlaomer king of Elam was at the head of the confederacy. Amraphel king of Shinar, that is Babylon or Chaldea, was one of the allies; Arioch king of Elasar was another; and Tidal, king of some scattered nations in the same neighbourhood, was the fourth. That Chedorlaomer was principal in this expedition, is obvious from the historian's detail of the second, where that prince is placed first, and the rest are named *the kings that were with him*. This passage likewise demonstrates, that Elam, Shinar, and Elasar, lay contiguous, and were engaged in the same cause. Wherever the country in question is mentioned in Scripture prior to the era of Daniel and Ezra, it is always under the name of *Elam*. To go about to prove this would be superfluous.

According to Xenophon §, the Persians knew nothing of horsemanship before the age of Cyrus: but that historian informs us, that after that monarch had introduced the practice of fighting on horseback, they became so fond of it, that no man of rank would deign to fight on foot. Here it ought to be considered, that the historian above mentioned was now writing a moral, military, and political romance; and therefore introduces this anecdote, in order to exalt the character of his hero: so that we are not to suppose that the people under consideration were unacquainted with the art of horsemanship till that period.

The very name *Phars* or *Pharas* is certainly of Hebrew origin, and alludes to the skill that people professed in horsemanship. The original seems to be *Pharsah*, *ungula*, "a hoof;" and in the Arabic *Pharas* intimates a *horse*, and *Pharis* a *horseman*. Consequently the people were denominated *Parsai*, and the country *Pars*, because they were trained from their infancy to ride the *great horse*, which indeed they deemed their greatest honour. This name was perhaps first imposed upon them by the neighbouring nations, and in process of time became their gentile appellation. *Mithras* is generally known to have been the chief divinity of the Persians; a name which is plainly derived from *Mither*, "great." We find in Strabo the Persian god *Amanus*, which is plainly a cognate of *Hamah*, the "sun or fire." Hence we believe comes *Hamarim*, the "hearths or chapels," where the fire sacred to the sun was kept burning; which, we believe, the Greeks called Πυραθεια, or "fire-temples." Herodotus † mentions a custom among the Persians, according to which, when they came to engage an enemy, they cast a rope with a kind of gin at the end of it on their enemy, and by those means endeavoured to entangle and draw him into their power. The people of Persia who employed this net or gin were called *Sargates*, from *sarags*, *sherag*, or *serig*, a word which in Hebrew, Arabic, and Chaldaic, signifies to "hamper or entangle:" hence perhaps the Greek word Σαργανη, a "basket or net." *Sar* or *zar* in Hebrew, Phœnician, Syriac, &c. signifies "a lord, a prince;" and hence we have the initial syllable of the far-famed *zar-tusht*, *Zoroastres*. In a word, most of the Persian names that occur in the Grecian histories, notwithstanding the scandalous manner in which they have been disguised and metamorphosed by the Greeks, may still with a little skill and industry be traced back to a Hebrew, Chaldaic, Syriac, or Phœnician origin. In the books of Daniel, Ezra, Nehemiah, and Esther, we find a number of Persian names which are all of a Hebrew or Chaldaic complexion: to investigate these at much greater length would be foreign to the design of the present article. If our curious reader should incline to be more fully satisfied as to this point, he may consult Bochart's *Chanaan*, D'Herbelot's *Bib. Orient.* Walton's *Proleg.* &c.

It now appears, we hope, to the entire satisfaction of our readers, that the Pahlavi is a remnant of the old Persian, and that the latter is a cognate branch of the Hebrew, Chaldaic, Syriac, &c. We have likewise adduced some presumptive proofs that the Zend was copied from the sacred language of the Egyptians: we shall now endeavour to explain by what changes and revolutions the language first mentioned arrived at its present summit of beauty and perfection.

85
Progress of the Persian language.

We have observed above, that the Scythians, whom the old Persians called Σακαι, *Sacæ*, and whom the modern call *Turan*, often invaded and overran Persia at a very early period. The consequence was, an infusion of Scythian or Tartarian terms, with which that language was early impregnated. This in all probability occasioned the first deviation from the original standard. The conquests of Alexander, and the dominion of his successors, must, one would imagine, introduce an inundation of Greek words. That event, however, seems to have affected the language in no considerable degree, at least very few Grecian terms occur in the modern Persian.

The empire of the *Arsacidæ* or Parthians, we apprehend, produced a very important alteration upon the ancient Persian. They were a demi-Scythian tribe; and as they conquered the Persians, retained the dominion of those parts for several centuries, and actually incorpo-

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† *Strabo*, lib. 11.

‡ Gen. chap. xiv.

§ *Cyrop.* lib. 1.

† Lib. ix. cap. 85.

rated with the natives, their language must necessarily have given a deep tincture to the original dialect of the Persians. Sir William Jones has observed, that the letters of the inscriptions at *Istakhr* or Persepolis bear some resemblance to the old Runic letters of the Scandinavians. Those inscriptions we take to have been Parthian; and we hope, as the Parthians were a Tartarian clan, this conjecture may be admitted till another more plausible is discovered. The Persians, it is true, did once more recover the empire; and under them began the reign of the Deri and Parsi tongues: the former consisting of the old Persian and Parthian highly polished; the latter of the same languages in their uncultivated vernacular dress. In this situation the Persian language remained till the invasion of the Saracens in 636; when these barbarians overran and settled in that fine country; demolished every monument of antiquity, records, temples, palaces, every remain of ancient superstition; massacred or expelled the ministers of the Magian idolatry; and introduced a language, though not entirely new, yet widely differing from the old exemplar.

But before we proceed to give some brief account of the modern Persian, we must take the liberty to hazard one conjecture, which perhaps our adepts in modern Persian may not find themselves disposed to admit. In modern Persian we find the ancient Persian names wonderfully distorted and deflected from that form under which they appear in the Scripture, in Ctesias, Megasthenes, and the other Greek authors. From this it has been inferred, that not only the Greeks, but even the sacred historians of the Jews, have changed and metamorphosed them most unmercifully, in order to accommodate them to the standard of their own language. As to the Greeks, we know it was their constant practice, but we cannot believe so much of the Hebrews. We make no doubt of their writing and pronouncing the names of the Persian monarchs and governors of that nation nearly in the same manner with the native Persians. It is manifest, beyond all possibility of contradiction, that they neither altered the Tyrian and Phœnician names of persons and places when they had occasion to mention them, nor those of the Egyptians when they occurred in their writings. The Babylonian and Chaldaic names which are mentioned in the Old Testament vary nothing from the Chaldean original. No reason can be assigned why they should have transformed the Persian names more than the others. On the contrary, in Ezra, Nehemiah, and Esther, we find the Persian names faithfully preserved throughout.

86 Nothing now existing in Persic, except the Zend, older than the Saracen conquest.

The fact, we imagine, is this: Our modern admirers of the Persic have borrowed their names of the ancient kings and heroes of that country from romances and fabulous legends of more modern date and composition. The archives of Persia were destroyed by the Saracens: nothing of importance was written in that country till two centuries after the era of Mohammed. What succeeded was all fiction and romance. The authors of those entertaining compositions either forged names of heroes to answer their purpose, or laid hold on such as were celebrated in the ballads of their country, or preserved by vulgar tradition. The names were no doubt very different from those of the ancient kings and heroes of Persia; and probably many of them had undergone considerable changes during the continuance of the Parthian empire. Upon this foundation has the learned Mr Richardson erected a very irregular fabric, new, and to use his own expression, we think built upon *pillars of ice*. He has taken much pains to invalidate the credit of the Grecian histories of the Persian empire, by drawing up in battle array against their records legions of romantic writers, who were not born till near 1000 years after the events had taken place; and to complete the probability, who lived 200 years after all the chronicles of the Medes and Persians had been finally destroyed by the fury of the Saracens.

After the decisive victory obtained over the Persians at Kadessa, their ancient government was overturned, their religion proscribed, their laws trampled under foot, and their civil transactions disturbed by the forcible introduction of the lunar for the solar kalendar; while, at the same time, their language became almost overwhelmed by an inundation of Arabic words: which from that period, religion, authority, and fashion, incorporated with their idiom.

87 The most flourishing period of Persian literature.

From the seventh till the tenth century the Persian tongue, now impregnated with Arabic words, appears to have laboured under much discouragement and neglect. Bagdad, built by Almansor, became soon after the year 762 the chief residence of the caliphs, and the general resort of the learned and the ambitious from every quarter of the empire. At length the accession of the Buyah princes to the Persian throne marked in the tenth century the great epoch of the revival of Persian learning. About the year 977 the throne of Persia was filled by the great Azaduddawla; who first assumed the title of *Sultan*, afterwards generally adopted by eastern princes. He was born in Ispahan, and had a strong attachment to his native kingdom. His court, whether at Bagdad or in the capital of Persia, was the standard of taste and the favourite residence of genius. The native dialect of the prince was particularly distinguished, and became soon the general language of composition in almost every branch of polite learning. From the end of the tenth till the 15th century may be considered as the most flourishing period of Persian literature. The epic poet Firdausi, in his romantic history of the Persian kings and heroes, displays an imagination and smoothness of numbers hardly inferior to Homer. The whole fanciful range of Persian enchantment he has interwoven in his poems, which abound with the noblest efforts of genius. This bard has stamped a dignity on the monsters and fictions of the east, equal to that which the prince of epic poetry has given to the mythology of ancient Greece. His language may at the same time be considered as the most refined dialect of the ancient Persian, the Arabic being introduced with a very sparing hand: whilst Sadi, Jami, Hafiz, and other succeeding writers, in prose as well as verse, have blended in their works the Arabic without reserve; gaining perhaps in the nervous luxuriance of the one language what may seem to have been lost in the softer delicacy of the other. Hence Ebn Fekreddin Anju, in the preface to the dictionary called *Farhang Jehanguiri*, says, that the Deri and the Arabic idioms were the languages of heaven; God communicating to the angels his milder mandates in the delicate accents of the first, while his stern commands were delivered in the rapid accents of the last.

For near 300 years the literary fire of the Persians seems indeed to have been almost extinguished; since, during that time, hardly any thing of that people which deserves attention has appeared in Europe: enough, however, has already been produced, to inspire us with a very high opinion of the genius of the east. In taste, the orientals are undoubtedly inferior to the best writers of modern Europe; but in invention and sublimity, they are excelled, perhaps equalled, by none. The Persians affect a rhetorical luxuriance, which to a European wears the air of unnecessary redundance. If to these leading distinctions we add a peculiar tone of imagery, of metaphor, of allusion, derived from the difference of government, of manners, of temperament, and of such natural objects as characterise Asia from Europe; we shall see, at one view, the great points of variation between the writers of the east and west. Amongst the oriental historians, philosophers, rhetoricians, and poets, many will be found who would do honour to any age or people; whilst their romances, their tales, and their fables, stand upon a ground which Europeans have not yet found powers to reach. We might here quote the Arabian Nights Entertainments, Persian Tales, Pilpay's Fables, &c.

88 The genius of the modern Persic.

We shall now annex a few strictures on the genius of that noble language; though it is our opinion that the province of the philologist is to investigate the origin, progress, and final improvement of a language, without descending to its grammatical minutiæ or peculiar idiomatic distinctions. We have already observed, that the tongue under consideration is partly Arabic and partly Persian, though the latter generally has the ascendant. The former is nervous, impetuous, and masculine; the latter is flowing, soft, and luxuriant. Wherever the Arabic letters do not readily incorporate with the Persian, they are either changed into others or thrown away. Their letters are the Arabic with little variation; these being found more commodious and expeditious than the old letters of the Deri and Parsi. Their alphabet consists of 32 letters, which, like the Arabic, are read from right to left; their form and order will be learned from any grammar of that language. The letters are divided into vowels and consonants as usual. The Arabic characters, like those of the Europeans, are written in a variety of different hands; but the Persians write their poetical works in the Talick, which answers to the most elegant of our Italic hands.

89 Resemblance between Persian and English.

There is a great resemblance between the Persian and English languages in the facility and simplicity of their form and construction: the former, as well as the latter, has no difference of terminations to mark the gender either in substantives or adjectives; all inanimate things are neuter; and animals of different sexes have either different names, or are distinguished by the words *ner*, male, and *made*, female. Sometimes indeed a word is made feminine, after the manner of the Arabians, by having *a* added to it.

The Persian substantives have but one variation of case, which is formed by adding a syllable to the nominative in both numbers; and answers often to the dative, but generally to the accusative, case in other languages. The other cases are expressed for the most part by particles placed before the nominative. The Persians have two numbers, singular and plural; the latter is formed by adding a syllable to the former.

The Persian adjectives admit of no variation but in the degrees of comparison. The comparative is formed by adding *ter*, and the superlative by adding *terin* to the positive.

The Persians have active and neuter verbs like other nations; but many of their verbs have both an active and neuter sense, which can be determined only by the construction. Those verbs have properly but one conjunction, and but three changes of tense: the imperative, the aorist, and the preterite; all the other tenses being formed by the help of particles or of auxiliary verbs. The passive voice is formed by adding the tenses of the substantive verb to the participle of the active.

In the ancient language of Persia there were very few or no irregularities; the imperative, which is often irregular in the modern Persian, was anciently formed from the infinitive, by rejecting the termination *eeden*: for originally all infinitives ended in *den*, till the Arabs introduced their harsh consonants before that syllable, which obliged the Persians, who always affected a sweetness of pronunciation, to change the old termination of some verbs into *ten*, and by degrees the original infinitive grew quite obsolete; yet they still retain the ancient imperative, and the aorists which are formed from it. This little irregularity is the only anomalous part of the Persian language; which nevertheless far surpasses in simplicity all other languages ancient or modern.

With respect to the more minute and intricate parts of this language, as well as its derivations, compositions, constructions, &c. we most remit our readers to Mininskie's *Institutiones Linguæ Turcicæ, cum rudimentis parallelis linguarum Arab. et Pers.*; Sir William Jones's Persian Grammar; Mr Richardson's Arabian and Persian Dictionary; D'Herbelot's *Bibl. Orient.*; Dr Hyde *de Relig. vet. Pers.* &c. Our readers, who would penetrate into the innermost recesses of the Persian history, colonies, antiquities, connections, dialects, may consult the last mentioned author, especially chap. xxxv. *De Persia et Persarum nominibus, et de moderna atque veteri lingua Persica, ejusque dialectis.* In the preceding inquiry we have followed other authors, whose accounts appeared to us more natural, and much less embarrassing.

90 Utility of the Arabian and Persian languages.

To conclude this section, which might easily have been extended into a large volume, we shall only take the liberty to put our readers in mind of the vast utility of the Arabian and Persian languages. Numberless events are preserved in the writing of the orientals which were never heard of in Europe, and must have for ever lain concealed from the knowledge of its inhabitants, had not these two tongues been studied and understood by the natives of this quarter of the globe. Many of those events have been transmitted to posterity in poems and legendary tales like the Runic fragments of the north, the romances of Spain, or the heroic ballads of our own country. Such materials as these, we imagine, may have suggested to Firdausi, the celebrated heroic poet of Persia, many of the adventures of his *Shahnumé*; which, like Homer when stript of the machinery of supernatural beings, is supposed to contain much true history, and a most undoubted picture of the superstition and manners of the times. The knowledge of these two languages has laid open to Europe all the treasures of oriental learning, and has enriched the minds of Britons with Indian science as much as the prudence of the regions has increased their wealth and enervated their constitution.

91 Persian poetry.

Before we conclude this section, we shall subjoin a few strictures on the nature of Persian poetry, in order to render our inquiry the more complete. The modern Persians borrowed their poetical measures from the Arabs: they are exceedingly various and complicated; they consist of 19 different kinds; but the most common of them are the *Iambic* or *Trochaic* measures, and a metre that chiefly consists of those compounded feet which the ancients called **Επιτριτους**, which are composed of iambics and spondees alternately. In lyric poetry their verses generally consist of 12 or 16 syllables: they sometimes, but seldom, consist of 14. Some of their lyric verses contain 13 syllables; but the most common Persian verse is made up of 11; and in this measure are written all their great poems, whether upon heroic or moral subjects, as the works of Firdausi and Jami, the Bostar of Sadi, and the Mesnavi of Gelaleddin. This sort of verse answers to our common heroic rhyme, which was brought to so high a degree of perfection by Pope. The study of the Persian poetry is so much the more necessary, as there are few books or even letters written in that language, which are not interspersed with fragments of poetry. As to their prosody, nothing can be more easy and simple. When the student can read prose easily, he will with a little attention read poetry with equal facility.

SECT. V. *Sanscrit and Bengalese Languages.*

92 The Sanscrit one of the most ancient languages in the world.

THE Sanscrit, though one of the most ancient languages in the world, was little known even in Asia till about the middle of the present century. Since that period, by the indefatigable industry of the very learned and ingenious Sir William Jones, and the other worthy members of that society of which he has the honour to be president, that noble and ancient language has at length been brought to light; and from it vast treasures of oriental knowledge will be communicated both to Europe and Asia; knowledge which, without the exertions of that happy establishment, must have lain concealed from the researches of mankind to the end of the world. In this section we propose to give to our readers such an account of that language as the limits of the present article, and the helps we have been able to procure, shall permit.

The Sanscrit language has for many centuries lain concealed in the hands of the bramins of Hindostan. It is by them deemed sacred, and is of consequence confined solely to the offices of religion. Its name imports the *perfect language*, or, according to the eastern style, *the language of perfection;* and we believe no language ever spoken by man is more justly intitled to that high epithet.

93 Traces of Sanscrit in every district of Asia and elsewhere.

The grand source of Indian literature, and the parent of almost every dialect from the Persian gulf to the China seas, is the Sanscrit; a language of the most venerable and most remote antiquity, which, though at present shut up in the libraries of the bramins, and appropriated solely to the records of their religion, appears to have been current over most of the oriental world. Accordingly traces of its original extent may be discovered in almost every district of Asia. Those who are acquainted with that language have often found the similitude of Sanscrit words to those of Persian and Arabic, and even of Latin and Greek; and that not in technical and metaphorical terms, which refined arts and improved manners might have occasionally introduced, but in the main ground-work of language, in monosyllables, the names of numbers, and appellations of such things as would be first discriminated on the immediate dawn of civilization.

The ancient coins of many different and distant kingdoms of Asia are stamped with Sanscrit characters, and mostly contain allusions to the old Sanscrit mythology. Besides, in the names of persons and places, of titles and dignities, which are open to general notice, even to the farthest limits of Asia, may be found manifest traces of the Sanscrit. The scanty remains of Coptic antiquities afford little scope for comparison between that idiom and this primitive tongue; but there still exists sufficient ground to conjecture, that, at a very early period, a correspondence did subsist between these two nations. The Hindoos pretend, that the Egyptians frequented their country as disciples, not as instructors; that they came to seek that liberal education and those sciences in Hindostan, which none of their own countrymen had sufficient knowledge to impart. Perhaps we may examine the validity of this claim hereafter.

94 Number of books in that language.

But though numberless changes and revolutions have from time to time convulsed Hindostan, that part of it which lies between the Indus and the Ganges still preserves that language whole and inviolate. Here they still offer a thousand books to the perusal of the curious; many of which have been religiously handed down from the earliest periods of human existence.

95 Characteristics of it.

The fundamental part of the Sanscrit language is divided into three classes: *Dhaat*, or roots of verbs, which some call primitive elements; *Shubd*, or original nouns; and *Evya*, or particles. The latter are ever indeclinable, as in other languages; but the words comprehended in the two former classes must be prepared by certain additions and inflexions to fit them for a place in composition. And here it is that the art of the grammarian has found room to expand itself, and to employ all the powers of refinement. Not a syllable, not a letter, can be added or altered but by regimen; not the most trifling variation of the sense, in the minutest subdivision of declension or conjugation, can be effected without the application of several rules: all the different forms for every change of gender, number, case, person, tense, mood, or degree, are methodically arranged for the assistance of the memory, according to an unerring scale. The number of the radical or elementary parts is about 700; and to these, as to the verbs of other languages, a very plentiful stock of verbal nouns owes its origin; but these are not thought to exceed those of the Greek either in quantity or variety.

To the triple source of words mentioned above, every term of truly Indian original may be traced by a laborious and critical analysis. All such terms as are thoroughly proved to bear no relation to any one of the Sanscrit roots, are considered as the production of some remote and foreign idiom, subsequently ingrafted upon the main stock; and it is conjectured, that a judicious investigation of this principle would throw a new light upon the first invention of many arts and sciences, and open a fresh mine of philological discoveries. We shall now proceed to give as exact an account of the constituent parts of this language as the nature of our design will permit.

96 It is copious and nervous.

The Sanscrit language is very copious and nervous. The first of these qualities arises in a great measure from the vast number of compound words with which it is almost overstocked. "The Sanscrit (says Sir William Jones) like the Greek, Persian, and German, delights in compounds; but to a much higher degree, and indeed to such excess, that I could produce words of more than 20 syllables; not formed ludicrously like that by which the buffoon in Aristophanes describes a feast, but with perfect seriousness, on the most solemn occasions, and in the most elegant works." But the style of its best authors is wonderfully concise. In the regularity of its etymology it far exceeds the Greek and Arabic; and, like them, has a prodigious number of derivatives from each primary root. The grammatical rules also are numerous and difficult, though there are not many anomalies. As one instance of the truth of this assertion, it may be observed, that there are seven declensions of nouns, all used in the singular, the dual, and the plural numbers, and all of them differently formed, according as they terminate with a consonant, with a long or a short vowel; and again, different also as they are of different genders: not a nominative case can be formed to any one of these nouns without the application of at least four rules, which vary likewise with each particular difference of the nouns, as above stated: add to this, that every word in the language may be used through all the seven declensions, which is a full proof of the difficulty of the idiom.

The Sanscrit grammars are called *Beeăkĕrun*, of which there are many composed by different authors; some too abstruse even for the comprehension of most bramins, and others too prolix to be ever used as references. One of the shortest, named the *Sārăsootee*, contains between two and three hundred pages, and was compiled by Anoŏbhōōtēē Seroopĕnām Achārige, with a conciseness that can scarcely be paralleled in any other language.

97 Sanscrit alphabet.

The Sanscrit alphabet contains 50 letters; and it is one boast of the bramins, that it exceeds all other alphabets in this respect: but it must be observed, that as of their 34 consonants, near half carry combined sounds, and that six of their vowels are merely the correspondent long ones to as many which are short, the advantage seems to be little more than fanciful. Besides these, they have a number of characters which Mr Halhed calls connected vowels, but which have not been explained by the learned president of the Asiatic Society.

† Plate CCCCXVI.

The Sanscrit character used in Upper Hindostan † is said to be the same original letter that was first delivered to the people by Brahma, and is now called *Dīewnāgur*, or the language of angels, which shows the high opinion that the bramins have entertained of that character. Their consonants and vowels are wonderfully, perhaps whimsically, modified and diversified; to enumerate which, in this place, would contribute very little either to the entertainment or instruction of our readers. All these distinctions are marked in the *Beids* (L), and must be modulated accordingly; so that they produce all the effect of a laboured recitative: but by an attention to the music of the chant, the sense of the passage recited equally escapes the reader and the audience. It is remarkable, that the Jews in their synagogues chant the Pentateuch in the same kind of melody; and it is supposed that this usage has descended to them from the remotest ages.

98 Poetry.

The Sanscrit poetry comprehends a very great varietry of different metres, of which the most common are these:

The *munnee hurreneh chhund*, or line of 12 or 19 syllables, which is scanned by three syllables in a foot, and the most approved foot is the anapæst.

The *cābee chhund*, or line of eleven syllables.

The *anŭshtoſe chhund*, or line of eight syllables.

The poems are generally composed in stanzas of four lines, called *ashlogues*, which are regular or irregular.

The most common ashlogue is that of the *anŭshtoſe chhund*, or regular stanza of eight syllables in the line. In this measure the greatest part of the *Māhābăret* is composed. The rhyme in this kind of stanza should be alternate; but the poets do not seem to be very nice in the observance of a strict correspondence in the sounds of the terminating syllables, provided the feet of the verse are accurately kept.

This short *anŭshtoſe ashlogue* is generally written by two verses in one line, with a pause between; so the whole then assumes the form of a long distich.

The irregular stanza is constantly called *anyăchhund*, of whatever kind of irregularity it may happen to consist. It is most commonly compounded of the long line *cābee chhund* and the short *anŭshtoſe chhund* alternately; in which form it bears some resemblance to the most common lyric measure of the English.

99 Origin of this tongue.

Perhaps our readers may feel a curiosity to be informed of the origin of this oriental tongue. If we believe the bramins themselves, it was coeval with the race of man, as was observed towards the beginning of this section. The bramins, however, are not the only people who ascribe a kind of eternity to their own particular dialect. We find that the Sanscrit in its primitive destination was appropriated to the offices of religion. It is indeed pretended, that all the other dialects spoken in Hindostan were emanations from that fountain, to which they might be traced back by a skilful etymologist. This, we think, is an argument of no great consequence, since we believe that all the languages of Europe, by the same process, may be deduced from any one of those current in that quarter of the globe. By a parity of reason, all the different dialects of Hindostan may be referred to the language in question. Indeed, if we admit the authority of the Mosaic history, all languages whatsoever are derived from that of the first man. It is allowed that the language under consideration is impregnated with Persian, Chaldaic, Phœnician, Greek, and

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(L) The books which contain the religion of the bramins.

and even Latin idioms. This, we think, affords a presumption that the Sancrit was one of those original dialects which were gradually produced among the descendants of Noah, in proportion as they gradually receded from the centre of population. What branch or branches of that family emigrated to Hindostan, it is not easy to determine. That they were a party of the descendants of Shem is most probable, because the other septs of his posterity settled in that neighbourhood. The sum then is, that the Hindoos were a colony consisting of the descendants of the patriarch Shem.

It appears, however, by almost numberless monuments of antiquity still existing, that at a very early period a different race of men had obtained settlements in that country. It is now generally admitted, that colonies of Egyptians had peopled a considerable part of Hindostan. Numberless traces of their religion occur everywhere in those regions. The very learned president himself is positive, that vestiges of those sacerdotal wanderers are found in India, China, Japan, Tibet, and many parts of Tartary. Those colonists, it is well known, were zealous in propagating their religious ceremonies wherever they resided, and wherever they travelled. There is at the same time even at this day a striking resemblance between the sacred rites of the vulgar Hindoos and those of the ancient Egyptians. The prodigious statues of Salsette and Elephanta fabricated in the Egyptian style; the vast excavations hewn out of the rock in the former; the woolly hair of the statues, their distorted attitudes, their grotesque appearances, their triple heads, and various other configurations —plainly indicate a foreign original. These phenomena suit no other people on earth so exactly as the sons of Mizraim. The Egyptian priests used a sacred character, which none knew but themselves; none were allowed to learn except their children and the choice of the initiated. All these features mark an exact parallel with the bramins of the Hindoos. Add to this, that the dress, diet, lustrations, and other rites of both sects, bore an exact resemblance to each other. Sir William Jones has justly observed, that the letters of the Sanscrit, stript of all adventitious appendages, are really the square Chaldaic characters. We learn from Cassiodorus † the following particulars: "The height of the obelisks is equal to that of the circus; now the higher is dedicated to the sun, and the lower to the moon, where the sacred rites of the ancients are intimated by Chaldaic signatures by way of letters." Here then it is plain that the sacred letters of the Egyptians were Chaldaic, and it is allowed that those of the bramins were of the same complexion; which affords a new presumption of the identity of the Sancrit with those just mentioned.

That the Egyptians had at a very early period penetrated into Hindostan, is universally admitted. Osiris, their celebrated monarch and deity, according to their mythology, conducted an army into that country; taught the natives agriculture, laws, religion, and the culture of the vine, &c. He is said at the same time to have left colonies of priests, as a kind of missionaries, to instruct the people in the ceremonies of religion. Sesostris, another Egyptian potentate, likewise overran Hindostan with an army, and taught the natives many useful arts and sciences. When the pastor-kings invaded and conquered Egypt, it is probable that numbers of the priests, in order to avoid the fury of the merciless invaders, who demolished the temples and persecuted the ministers of religion, left their native country, and transported themselves into India. These, we should think, were the authors both of the language and religion of the bramins. This dialect, as imported by the Egyptians, was probably of the same contexture with the sacred language of that people, as it appeared many ages after. The Indians, who have always been an inventive and industrious race of men, in process of time cultivated, improved, diversified, and constructed that language with such care and assiduity, that it gradually arrived at that high degree of perfection in which at present it appears.

Had the learned president of the Asiatic Society (M), when he instituted a comparison between the deities of Hindostan on the one side and of Greece and Italy on the other, examined the analogy between the gods of Hindostan and those of Egypt, we think he would have performed a piece of service still more eminent. Having first demonstrated the similarity between the divinities of India and Egypt, he might then have proceeded to investigate the resemblance of the Egyptian and Phœnician with those of Greece and Rome. By this process a chain would have been formed which would have conducted his reader to comprehend at one view the identity of the Zabian worship almost throughout the world.

We foresee that it will be objected to this hypothesis, that all the dialects of Hindostan being clearly reducible to the Sanscrit, it is altogether impossible that it could have been a foreign language. To this we answer, that at the early period when this event is supposed to have taken place, the language of the posterity of the sons of Noah had not deviated considerably from the primitive standard, and consequently the language of the Egyptians and the Hindoos was nearly the same. The Sanscrit was gradually improved: the language of the vulgar, as is always the case, became more and more different from the original archetype; but still retained such a near resemblance to the mother-tongue as proved the verity of its extraction.

100
Bengalese language derived from the Sanscrit.

To the preceding account of the Sanscrit language we shall annex a few strictures on the language of Bengal, which we believe is derived from the other, and is in most common use in the southern parts of Hindostan.

Though most of the ancient oriental tongues are read from right to left, like the Hebrew, Chaldaic, Arabic, &c. yet such as properly belong to the whole continent of India proceed from left to right like those of Europe. The Arabic, Persian, &c. are the grand sources whence the former method has been derived; but with these, the numerous original dialects of Hindostan have not the smallest connection or resemblance.

The great number of letters, the complex mode of combination, and the difficulty of pronunciation, are considerable

† Lib. iii. epist. 2. et 51.

(M) See that gentleman's discourse, *Researches*, vol. i.

considerable impediments to the study of the Bengal language; and the carelessness and ignorance of the people, and the inaccuracy of their characters, aggravate these inconveniences. Many of their characters are spurious; and these, by long use and the hurry of business, are now almost naturalized into the language.

101
Bengal alphabet.

The Bengal alphabet, like that of the Sanscrit, from which it is derived, consists of 50 letters, whose form, order, and sound, may be learned from Mr Halhed's grammar of the Bengal language. The vowels are divided into long and short, the latter of which are often omitted in writing. Most of the oriental languages are constructed upon the same principle, with respect to the omission of the short vowel. The Hebrews had no sign to express it before the invention of the Masoretic points; in Arabic it is rarely inserted unless upon very solemn occasions, as in the Koran; in the modern Persian it is universally omitted: so to all the consonants in the Sanscrit, the short vowel is an invariable appendage, and is never signified by any diacritical mark; but where the construction requires that the vowel should be dropped, a particular stroke is set under the letter. It is in vain to pretend, in a sketch like this, to detail the sound and pronunciation of these letters: this must be acquired by the ear and by practice.

102
Genders, &c. of this language.

In the Bengal language, there are three genders, as in Greek, Arabic, &c. The authors of this threefold division of genders, with respect to their precedence, appear to have considered the neuter as a kind of residuum resulting from the two others, and as less worthy or less comprehensive than either (see section of the *Greek*). The terminations usually applied upon this occasion are *aa* for the masculine, and *ee* for the feminine. In Sanscrit, as in Greek and Latin, the names of all things inanimate have different genders, founded on vague and incomprehensible distinctions: the same is the case with the Bengal.

103
Peculiarities of Sanscrit and Bengalese nouns.

A Sanscrit noun, on its first formation from the general root, exists equally independent of case as of gender. It is neither nominative, nor genitive, nor accusative; nor is impressed with any of those modifications which mark the relation and connection between the several members of a sentence. In this state it is called an *imperfect* or *crude* noun. To make a nominative of a word, the termination must be changed and a new form supplied. Thus we see, that, in the Sanscrit at least, the nominative has an equal right with any other inflection to be called a case. Every Sanscrit noun has seven cases, exclusive of the vocative; and therefore comprehends two more than even those of the Latin. Mr Halhed above mentioned details all the varieties of these with great accuracy, to whose grammar we must refer our readers. The Bengal has only four cases beside the vocative; in which respect it is much inferior to the other.

It would be difficult to account for the variety of words which have been allotted to the class of pronouns by European grammarians. The first and second person are chiefly worthy of observation; these two should seem to be confined to rational and conversable beings only: the third supplies the place of every object in nature; wherefore it must necessarily be endued with a capacity of shifting its gender respectively as it shifts the subject; and hence it is in Sanscrit frequently denominated an adjective. One of the demonstratives *hic* or *ille* usually serves for this purpose; and generally the latter, which in Arabic has no other name than *dhemeer el ghaayb*, "the pronoun of the absentee," for whose name it is a substitute.

104
Bengalese pronouns.

In most languages where the verb has a separate inflection to each person, that inflection is sufficient to ascertain the personality; but in Bengal compositions, though the first and second persons occur very frequently, nothing is more rare than the usage of the pronoun of the third; and names of persons are inserted with a constant and disgusting repetition, to avoid, as it should seem, the application of the words HE and SHE. The second person is always ranked before the first, and the third before the second. The personal pronouns have seven cases, which are varied in a very irregular manner. Leaving these to the Bengalian grammar, we shall proceed to the *verb*.

The Sanscrit, the Arabic, the Greek and Latin verbs, are furnished with a set of inflections and terminations so comprehensive and so complete, that by their form alone they can express all the different distinctions both of persons and time. Three separate qualities in them are perfectly blended and united. Thus by their root they denote a particular act, and by their inflection both point out the time when it takes place and the number of the agents. In Persian, as in English, the verb admits but of two forms, one for the present tense and one for the aorist; and it is observable, that while the past tense is provided for by a peculiar inflection, the future is generally supplied by an additional word conveying only the idea of time, without any other influence on the act implied by the principal verb. It is also frequently necessary that the different state of the action, as perfect or imperfect, be further ascertained in each of the tenses, past, present, and future. This also, in the learned languages, is performed by other variations of inflections, for which other verbs and other particles are applied in the modern tongues of Europe and Persia.

105
Middle voice of Sanscrit verbs.

Every Sanscrit verb has a form equivalent to the middle voice of the Greek, used through all the tenses with a reflective sense, and the former is even the most extensive of the two in its use and office: for in Greek the reflective can only be adopted intransitively when the action of the verb descends to no extraneous subject; but in Sanscrit, the verb is both reciprocal and transitive at the same time.

Neither the Sanscrit, nor the Bengalese, nor the Hindostanic, have any word precisely answering to the sense of the verb *I have*, and consequently the idea is always expressed by *est mihi;* and of course there is no auxiliary form in the Bengal verb correspondent to *I have written*, but the sense is conveyed by another mode. The very substantive, in all languages, is defective and irregular, and therefore the Sanscrit calls it a *semi-verb*. It is curious to observe that the present tense of this verb, both in Greek and Latin, and also in the Persian, appears plainly to be derived from the Sanscrit. In the Bengalese, this verb has but two distinctions of time, the present and the past; the terminations of the several persons of which serve as a model for those of the same tense in all other verbs respectively.

106
Characteristics of the Bengalese verbs.

Verbs of the Bengal language may be divided into three classes, which are distinguished by their penultimate letter. The simple and most common form has an open consonant immediately preceding the final letter of the infinitive. The second is composed of those words whose final letter is preceded by another vowel or open consonant going before it. The third consists entirely of causals derived from verbs of the first and second conjugations. The reader will easily guess at the impossibility of prosecuting this subject to any greater length: we shall therefore conclude with a few remarks collected from the grammar so often mentioned, which we apprehend may be more amusing, if not more instructing.

The Greek verbs in μι are formed exactly upon the same principle with the Sanscrit conjugations, even in the minutest particulars. Instances of this are produced in many verbs, which from a root form a new verb by adding the syllable *mi*, and doubling the first consonant. This mode furnishes another presumption of the Egyptian origin of the Sanscrit. Many Greeks travelled into Egypt; many Egyptian colonies settled in Greece. By one or other of those channels the foregoing innovation might have been introduced into the Greek language.

To form the past tense, the Sanscrit applies a syllabic augment, as is done in the Greek: the future has for its characteristic a letter analogous to that of the same tense in the Greek, and it omits the reduplication of the first consonant. It may be added, that the reduplication of the first consonant is not constantly applied to the present tense of the Sanscrit more than to those of the Greek.

The natural simplicity and elegance of many of the Asiatic languages are greatly debased and corrupted by the continual abuse of auxiliary verbs; and this inconvenience has evidently affected the Persian, the Hindostan, and the Bengal idioms.

The infinitives of verbs in the Sanscrit and Bengalese are always used as substantive nouns. Every body knows that the same mode of arrangement very often occurs in the Greek.

In the Sanscrit language, as in the Greek, there are forms of infinitives and of participles comprehensive of time; there are also other branches of the verb that seem to resemble the gerunds and supines of the Latin.

All the terms which serve to qualify, to distinguish, or to augment, either *substance* or *action*, are classed by the Sanscrit grammarians under one head; and the word used to express it literally signifies *increase* or *addition*. According to their arrangement, a simple sentence consists of three members; the *agent*, the *action*, the *subject;* which, in a grammatical sense, are reduced to two; the *noun* and the *verb*. They have a particular word to specify such words as amplify the noun which imports quality, and answers to our *adjectives* or *epithets:* Such as are applied to denote relation or connection, are intimated by another term which we may translate *preposition*.

107 Sanscrit and Bengalese adjectives.

The adjectives in Bengalese have no distinction of gender or number; but in Sanscrit these words preserve the distinction of gender, as in the Greek and Latin.

Prepositions are substitutes for cases, which could not have been extended to the number necessary for expressing all the several relations and predicaments in which a noun may be found, without causing too much embarrassment in the form of a declension. Those are too few in the Greek language, which occasions much inconvenience. See sect. *Greek.*

The Latin is less polished than the Greek, and of consequence bears a much nearer resemblance to the Sanscrit, both in words, inflections, and terminations.

The learned are now convinced that the use of numerical figures was first derived from India. Indeed the antiquity of their application in that country far exceeds the powers of investigation. All the numerals in Sanscrit have different forms for the different genders, as in Arabic. There appears a strong probability that the European method of computation was derived from India, as it is much the same with the Sanscrit, though we think the Europeans learned it from the Arabians. The Bengalese merchants compute the largest sums by *fours;* a custom evidently derived from the original mode of computing by the fingers.

The Sanscrit language, among other advantages, has a great variety in the mode of arrangement; and the words are so knit and compacted together, that every sentence appears like one complete word. When two or more words come together *in regimine*, the last of them only has the termination of a case; the others are known by their position; and the whole sentence so connected, forms but one compound word, which is called a *foot*.

Sect. VI. *Of the Chinese Language.*

108 Antiquity of the Chinese.

The Chinese, according to the most authentic accounts, are a people of great antiquity. Their situation was such, as, in the earliest ages of the world, in a great measure secured them from hostile invasion. Their little commerce with the rest of mankind precluded them the knowledge of those improvements which a mutual emulation had often generated among other nations, who were situated in such a manner, with relation to each other, as served to promote a mutual intercourse and correspondence. As China is a large and fertile country, producing all the necessaries, conveniencies, and even the luxuries of life, its inhabitants were not under the necessity of looking abroad for the two former, nor exposed to the temptation of engaging in foreign commerce, in order to procure the latter. Perfectly satisfied with the articles which their own country produced, they applied themselves entirely to the practice of agriculture and other arts connected with that profession; and their frugality, which they retain even to this day, taught them the lesson of being contented with little; of consequence though their population was almost incredible, the produce of their soil was abundantly sufficient to yield them a subsistence. Their inventions were their own; and as they borrowed nothing from other people, they gradually began to despise the rest of mankind, and, like the ancient Egyptians, branded them with the epithet of *barbarians*.

Those people had at an early period made amazing proficiency in the mechanical arts. Their progress in the liberal sciences, according to the latest and indeed the most probable accounts, was by no means proportioned. In mathematics, geometry, and astronomy, their knowledge was contemptible; and in ethics, or moral philosophy, the complexion of their laws and customs proves their skill to have been truly superficial. They value themselves very highly at present upon their oratorial talents; and yet of all languages spoken by any civilized people, theirs is confessedly the least improved. To what this untowardly defect is owing, the learned have not yet been able to determine.

109 Their language an original tongue.

The language of the Chinese is totally different from those of all other nations, and bears very strong marks of an original tongue. All its words are monosyllabic, and compositions and derivations are altogether unknown. Their nouns and verbs admit of no flexions; in short, every thing relating to their idioms is peculiar, and incapable of being compared with any other dialect spoken by any civilized people. Most barbarous languages exhibit something that resembles an attempt towards those diacritical modifications of speech; whereas the Chinese, after a space of 4000 years, have not advanced one step beyond the very first elements of ideal communication. This circumstance, we think, is a plain demonstration that they did not emigrate from that region where the primitive race of mankind is thought to have fixed its residence. Some have imagined, we believe with good reason, that they are a *Tartarian* race, which, breaking off from the main body of that numerous and widely extended people, directed their march towards the south-east. There, falling in with delightful and fertile plains which their posterity now inhabit, they found themselves accommodated so much to their liking, that they dropped all desire of changing their habitations. The country of China is, indeed, so environed with mountains, deserts, and seas, that it would have been difficult for men in their primitive state to have emigrated into any of the neighbouring regions. Thus secluded from the rest of mankind, the Chinese, in all probability, were left to the strength of their own inventive powers to fabricate a language, as well as the other arts and improvements necessary for the support and convenience of life.

It is indeed obvious that their stock of vocables, when they emigrated from Tartary, was neither ample nor properly accommodated to answer the purposes of the mutual conveyance of ideas. With this slender stock, however, they seem to have been satisfied; for it does not appear that any additions were afterwards made to that which was originally imported. Instead of framing a new race of terms by compounding their primitive ones; instead of diversifying them by inflections, or multiplying them by derivatives, as is done in every other language; they rather chose to retain their primitive words, and by a variety of modifications introduced upon their orthography or pronunciation, to accommodate them to a variety of significations. Were it possible to scrutinize all the Tartarian dialects, and to reduce them to their primitive monosyllabic character, perhaps the original language of the Chinese might be investigated and ascertained. We know that attempts have been made to compare it with some of the other Asiatic languages, especially the *Hebrew:* This labour has, however, proved unsuccessful, and no primeval identity has been discovered. Before this comparison could be instituted with the most distant prospect of success, the language last mentioned must be stripped of all its adventitious qualities; and not only so, but it must be reduced to the monosyllabic tone, and then contrasted with the Chinese monosyllables; an undertaking which we are persuaded would not be readily executed. After all, we are convinced that no resemblance of any importance would be discovered.

110 Process of its fabrication.

The Chinese language must then, in our opinion, have been a Tartarian dialect, as the people themselves were colonists from Tartary. We have observed above, that those people have not hitherto found out the art of composition of words. This is the more surprising, when we consider that, in the characters which form their written language, they employ many compositions. For example, the character by which they represent *misfortune*, is composed of one hieroglyphic which represents a *house*, and another which denotes *fire;* because the greatest misfortune that can befal a man is to have his house on fire. With respect to the language which they use in speech, though they very often employ many words to express one thing, yet they never run them together into one word, making certain changes upon them that they may incorporate the more conveniently, but always preserve them entire and unaltered.

111 Paucity of its words.

The whole number of words in the Chinese language does not exceed 1200: the nouns are but 326. It must certainly appear surprising, that a people whose manners are so highly polished and refined, should be able to express so many things as must of necessity attend such a course of life by so small a number of words, and those too monosyllables. The difficulties which attend this singular mode must be felt almost every instant; circumstances which, according to the ordinary course of things, should have induced them to attempt both an augmentation of the number of their words and an extension of those which they had by composition and derivation. We learn from Du-Halde * that the Chinese have two different dialects: the one vulgar, which is spoken by the vulgar, and varies according to the different provinces; the other is called the *Mandarin language*, and is current only among the learned. The latter is properly that which was formerly spoken at court in the province of *Kiang-nan*, and gradually spread among the polite people in the other provinces. Accordingly, this language is spoken with more elegance in the provinces adjoining to *Kiang-nan* than in any other part of the kingdom. By slow degrees it was introduced into all parts of the empire, and consequently became the universal language.

It then appears that the modern language of China was originally the court dialect, and utterly unknown to the bulk of the people. From this circumstance we think it may fairly be concluded that this dialect was deemed the royal tongue, and had been fabricated on purpose to distinguish it from the vulgar dialects. We learn from Heliodorus, that the † Ethiopians had a royal language which was the same with the sacred idiom of the Egyptians. This Mandarin tongue was originally an artificial dialect fabricated with a view to enhance the majesty of the court, and to raise its very style and diction above that of the rest of mankind. The Chinese, a wonderfully inventive people, might actually contrive a language of that complexion, with an intention to render it obscure and enigmatical (N). Such a plan would excite their admiration, and would at the same time greatly exceed their comprehension. In process of time, when the Chinese empire was extended, the Mandarins who had been brought up at court, and understood nothing of the provincial dialects, found it convenient to have the most eminent persons in every province taught the language employed by themselves, in order to qualify them for transacting the affairs of government with them in a language which both understood. By this means the royal dialect descended to the vulgar, and in process of time become universal. The Tartar dialect formerly in use vanished; only a few vestiges of it remained; which gradually incorporating with the royal language, occasioned the variation of provincial tongues above mentioned.

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* *Hist. of China*, vol ii.

† *Ethiop.* lib. vi.

We are therefore clearly of opinion, that the modern language of the Chinese was deduced from the original Mandarin, or court dialect, and that this last was an artificial speech fabricated by the skill and ingenuity of that wonderful people. The learned have long held it up as the primary dialect, because, say they, it bears all the signatures of an original unimproved language. In our opinion, nothing appears more ingeniously artificially. It is universally allowed that, in its structure, arrangement, idioms, and phraseology, it resembles no other language. Is not every learned man now convinced that all the Asiatic languages yet known, discover unequivocal symptoms of their cognation and family resemblance? The Ethiopians, Chaldeans, Arabians, Persians, Egyptians, Hebrews, Phœnicians, the Brahmans, Bengalese, the Hindoos bordering upon China, all speak only different dialects of one language, varying from the original in dialect only, some in a greater some in a lesser degree: why should the Chinese alone stand altogether insulated and unallied?

The languages of the North all wear congenial features. The Tartar or Tatar dialects of every clan, of every canton, of every denomination, exhibit the most palpable proofs of a near affinity: the Gothic and Sclavonian dialects, which pervade a great part of Europe and some parts of Asia, are obviously brethren, and may easily be traced up to an Asiatic original. Even some of the American jargon dialects contain vocables which indicate an Asiatic or European original. Our readers, we flatter ourselves, will agree with us, that had the language of the Chinese been the original language, a resemblance must have still existed between it and its descendants. If it had originated from any other language, it would have retained some characteristic features of its parent archetype. As neither of these is to be found in the fabric of the language under consideration, the conclusion must be, that it is a language entirely different from all other tongues; that it is constructed upon different principles, descended from different parents, and framed by different artists.

The Chinese themselves have a common and immemorial tradition, that their language was framed by *Yao* their first emperor, to whom they attribute the invention of every thing curious, useful, and ornamental. Traditional history, when it is ancient, uniform, and universal, is generally well founded: upon this occasion we think the tradition above mentioned may be fairly admitted as a collateral evidence.

112 A proof of its artificial structure.

The paucity of vocables contained in this singular language, we think another presumption of its artificial contexture. The Chinese *Onomathetæ* would find it an arduous task to devise a great number of new terms, and would therefore rest satisfied with the smallest number possible. In other languages we find the like economy was observed. Rather than fabricate new words, men chose sometimes to adapt old words to new, and, upon some occasions, even to contrary significations. To spare themselves the trouble of coining new terms, they contrived to join several old ones into one; whence arose a numerous race of compounds. Derivatives too were fabricated to answer the same purpose. By this process, instead of creating new vocables, old ones were compounded, diversified, deflected, ramified, metamorphosed, and tortured into a thousand different shapes.

The Greek is deservedly esteemed a rich and copious language; its radical words have been curiously traced by several learned men, who, after the most laborious and exact scrutiny, have found that they do not amount to more than 300. The Sanscrit language is highly compounded; its radical terms, however, are very few in number. Upon the whole, we think we may conclude, that the more any language abounds in compounds and derivatives, the smaller will be the number of its radical terms. The Arabic admits of no composition, and of consequence its words have been multiplied almost *in infinitum;* the Sanscrit, the Persian, and the Greek, abound with compounds, and we find their radicals are few in proportion.

113 Three different methods of enriching a language.

There are, we think, three different methods which may be employed in order to enrich and extend the range of a language. 1st, By fabricating a multitude of words; the plan which has been pursued by the Arabs. 2d, By framing a multitude of compounds and derivatives; the artifice employed by the Greeks and the authors of the Sanscrit. 3d, By varying the signification of words without enlarging their number; the method practised by the Chinese and their colonists. The Arabians, we think, have shown the most fertile and inventive genius, since they have enriched their language by actually creating a new and a most numerous race of words. The fabricators of the Sanscrit and the collectors of the Greek have exhibited art, but *comparatively* little fertility of genius. Leaving, therefore, the Arabians, as in justice we ought, masters of the field in the contest relating to the formation of language, we may range the Greek and Sanscrit on the one side, and the Chinese on the other; and having made this arrangement, we may attempt to discover on which side the largest proportion of genius and invention seems to rest.

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(N) An attempt of this nature, among a people like the Chinese, is by no means improbable; nor is its success less probable. For a proof of this, we need only have recourse to Bishop Wilkins's Artificial Language, and Psalmanazar's Dictionary of the language of Formosa.

Chinese Language.

The Greek and Sanscrit (for we have selected them as most highly compounded) exhibit a great deal of art in modifying, arranging, and diversifying their compounds and derivatives, in such a manner as to qualify them for intimating complex ideas; but the Chinese have performed the same office by the help of a race of monosyllabic notes, simple, inflexible, invariable, and at the same time few in number. The question then comes to be, whether more art is displayed in new-modelling old words by means of declensions, compounds, and derivatives; or by devising a plan according to which monosyllabic radical terms, absolutely invariable, should, by a particular modification of sound, answer all the purposes performed by the other. The latter appears to us much more ingeniously artificial. The former resembles a complicated machine composed of a vast number of parts, congenial indeed, but loosely connected; the latter may be compared to a simple, uniform engine, easily managed, and all its parts properly adjusted. Let us now see in what manner the people in question managed their monosyllabic notes, so as to qualify them for answering all the purposes of speech.

114 That adopted by the Chinese.

Though the number of words in the Chinese language does not amount to above 1200; yet that small number of vocables, by their artificial management, is sufficient to enable them to express themselves with ease and perspicuity upon every subject. Without multiplying words, the sense is varied almost *in infinitum* by the variety of the accents, inflections, tones, aspirations, and other changes of the voice and enunciation; circumstances which make those who do not thoroughly understand the language frequently mistake one word for another. This will appear obvious by an example.

The word *teov* pronounced slowly, drawing out the *v* and raising the voice, signifies a *lord* or *master*. If it is pronounced with an even tone, lengthening the *v*, it signifies a *hog*. When it is pronounced quick and lightly, it imports a *kitchen*. If it be pronounced in a strong and masculine tone, growing weaker towards the end, it signifies a *column*.

By the same economy, the syllable *po*, according to the various accents, and the different modes of pronunciation, has eleven different significations. It signifies *glass*, *to boil*, *to winnow rice*, *wise or liberal*, *to prepare*, *an old woman*, *to break or cleave*, *inclined*, *a very little*, *to water*, *a slave or captive*. From these examples, and from almost numberless others which might be adduced, it is abundantly evident that this language, which at first sight appears so poor and confined, in consequence of the small number of the monosyllables of which it is composed, is notwithstanding very copious, rich, and expressive.

Again, the same word joined to various others, imports a great many different things; for example *mou*, when alone, signifies a *tree*, *wood;* but when joined with another word, it has many other significations. *Mou leoo*, imports "wood prepared for building;" *mou lan* is "bars, or wooden grates;" *mou hia*, "a box;" *mou sang*, "a chest of drawers;" *mou tsiang*, "a carpenter;" *mou eul*, "a mushroom;" *mou nu*, "a sort of small orange;" *mou sing*, "the planet Jupiter;" *mou mien*, "cotton," &c. This word may be joined to several others, and has as many different significations as it has different combinations.

Chinese Language.

Thus the Chinese, by a different arrangement of their monosyllables, can compose a regular and elegant discoure, and communicate their ideas with energy and precision; nay even with gracefulness and propriety. In these qualities they are not excelled either by the Europeans or Asiatics, who use alphabetical letters. In fine, the Chinese so naturally distinguish the tones of the same monosyllable, that they comprehend the sense of it, without making the least reflection on the various accents by which it is determined.

115 Consequences of this method on pronunciation.

We must not, however, imagine, as some authors have related, that those people cant in speaking, and make a sort of music which is very disagreeable to the ear; these different tones are pronounced so curiously, that even strangers find it difficult to perceive their difference even in the province of *Kiang-nan*, where the accent is more perfect than in any other. The nature of it may be conceived by the guttural pronunciation in the Spanish language, and by the different tones that are used in the French and Italian; these tones are almost imperceptible; they have, however, different meanings, a circumstance which gave rise to the proverb, that *the tone is all.*

If the fineness and delicacy of their tones are such as to be scarce perceptible to a stranger, we must suppose that they do not rise high, but only by small intervals; so that the music of their language must somewhat resemble the music of the birds, which is within a small compass, but nevertheless of great variety of notes. Hence it will follow, that strangers will find it very difficult, if not impossible, to learn this language; more especially if they have not a delicate ear and a flexible voice, and also much practice. The great difference then between the Chinese and Greek accents consists in this, that the Greeks had but two accents, the grave and acute, distinguished by a large interval, and that not very exactly marked: for the acute, though it never rises above a fifth higher than the grave, did not always rise so high, but was sometimes pitched lower according to the voice of the speaker. The Chinese must have many more accents, and the intervals between them must be much smaller, and much more carefully marked: for otherwise it would be impossible to distinguish them. At the same time, their language must be much more musical than the Greek, and perhaps more so than any language ought to be; but this becomes necessary for the purposes above mentioned. Du Halde is positive, that notwithstanding the perpetual variation of accents in the Chinese tongue, and the almost imperceptible intervals between these tones, their enunciation does not resemble singing: many people, however, who have resided in China, are equally positive that the tone with which they utter their words does actually resemble *canting;* and this, when we consider the almost imperceptible intervals by which they are perpetually raising and lowering the tone of their voice, appears to us highly probable.

As the people of whose language we are treating at present communicate a variety of different significations to their monosyllabic words by their different accentuation, so they employ quantity for the very same purpose. By lengthening or shortening the vowels of their words, they employ them to signify very different things. The same they perform by giving their words different aspirations,

rations, as likewise by sounding them with different degrees of roughness and smoothness, and even sometimes by the different motion, posture, or attitude, with which their enunciation is accompanied. By these methods of diversifying their monosyllables (says Du Halde), they make 330 of them serve all the purposes of language, and these too not much varied in their termination; since all the words in that language either terminate with a vowel or with the consonant *n*, sometimes with the consonant *g* annexed.

From this account, we think it is evident that the Chinese, by a wonderful exertion of ingenuity, do, by different tones and prosodical modifications, by means of a very inconsiderable number of words, all invariable radicals, actually perform all that the most polished nations have been able to achieve by their compounds, derivatives, &c. diversified by declensions, conjugations, and flexions of every kind; circumstances which, in our opinion, reflect the greatest honour on their inventive powers.

116 Grammar of the Chinese.

With respect to the grammar of this language, as it admits of no flexions, all their words being indeclinable, their cases and tenses are all formed by particles. They have no idea of genders; and even the distinction of numbers, which in almost all other languages, even the most unimproved, is marked by a particular word, is in the Chinese only indicated by a particle. They have only the three simple tenses, namely, the past, present, and future; and for want of different terminations, the same word stands either for the verb or the verbal substantive, the adjective or the substantive derived from it, according to its position in the sentence.

The Chinese language being composed of monosyllables, and these indeclinable, can scarce be reduced to grammatical rules: we shall, however, attempt to lay before our readers as much of the texture of that singular dialect as may enable them to form some vague idea of its genius and constitution. We shall begin with the letters, and proceed regularly to the remaining parts as they naturally succeed each other.

117 Chinese letters or characters

The art of joining the Chinese monosyllables together is extremely difficult, and requires a very long and laborious course of study. As they have only figures by which they can express their thoughts, and have no accents in writing to vary the pronunciation, they are obliged to employ as many different figures or characters as there are different tones, which give so many different significations to the same word. Besides some single characters signify two or three words, and sometimes even a whole period. For example, to write these words, *good morrow, Sir*, instead of joining the characters which signify *good* and *morrow* with that of *Sir*, a different character must be used, and this character alone expresses these three words. This circumstance greatly contributes to multiply the Chinese characters.

This method of joining the monosyllables is indeed sufficient for writing so as to be understood; but it is deemed trifling, and is used only by the vulgar. The style that is employed, in order to shine in composition, is quite different from that which is used in conversation, though the words are in reality the same. In writings of that species, a man of letters must use more elegant phrases, more lofty expressions, and the whole must be dignified with tropes and figures which are not in general use, but in a peculiar manner adapted to the nature of the subject in question. The characters of Cochin-china, of Tong-king, of Japan, are the same with those of the Chinese, and signify the same things; though, in speaking, these nations do not express themselves in the same manner: of consequence the language of conversation is very different, and they are not able to understand each other; while, at the same time, they understand each other's written language, and use all their books in common.

118 exceedingly numerous.

The learned must not only be acquainted with the characters that are employed in the common affairs of life, but must also understand their various combinations, and the numerous and multiform dispositions and arrangements which of several simple strokes make the compound characters. The number of their characters amounts to 80,000; and the man who knows the greatest number of them is of course the most learned. From this circumstance we may conclude, that many years must be employed to acquire the knowledge of such a prodigious number of characters, to distinguish them when they are compounded, and to remember their shape and import. After all, a person who understands 10,000 characters may express himself with tolerable propriety in this language, and may be able to read and understand a great number of books. The generality of their learned men do not understand above 15,000 or 20,000, and few of their doctors have attained to the knowledge of above 40,000. This prodigious number of characters is collected in their great vocabulary called *Hai-pien*. They have radical letters, which show the origin of words, and enable them to find out those which are derived from them: for instance, the characters of mountains, trees, man, the earth, of a horse, under which must be sought all that belongs to mountains, trees, man, &c. In this search one must learn to distinguish in every word those strokes or figures which are above, beneath, on the sides, or in the body of the radical figure.

Clemens Alexandrinus (see Section *Chaldean*, &c.) informs us, that the Egyptians employed three sorts of characters: The first was called the *epistolary*, which was used in writing letters; the second was denominated *sacred*, and peculiar to the sacerdotal order; the last *hieroglyphical*, which was appropriated to monumental inscriptions and other public memorials. This mode of representation was twofold: one, and the most simple, was performed by describing the picture of the object which they intended to represent, or at least one that resembled it pretty nearly; as when they exhibited the sun by a circle and the moon by a crescent: the other was properly symbolic; as when they marked *eternity* by a serpent with his tail in his mouth, the *air* by a man clothed in an azure robe studded with stars, &c.

The Chinese, in all probability, had the same variety of characters. In the beginning of their monarchy, they communicated their ideas by drawing on paper the images of the objects they intended to express; that is, they drew the figure of a bird, a mountain, a tree, waving lines, to indicate birds, mountains, forests, rivers, &c.

There were, however, an infinite number of ideas to be communicated, whose objects do not fall under the cognizance of the senses; such as the soul, the thoughts, the passions, beauty, deformity, virtues, vices, the actions of men and other animals, &c. This inconvenience obliged them to alter their original mode of writing, which was too confined to answer that purpose, and to introduce characters of a more simple nature, and to invent others to express those things which are the objects of our senses.

119 and truly hieroglyphical. These modern characters are, however, truly hieroglyphical, since they are composed of simple letters which retain the signification of the primitive characters. The original character for the sun was a circle, thus ⊙; this they called *ga:* They now represent that luminary by the figure ☰|, to which they still give the original name. But human institutions having annexed to these last framed characters the very same ideas indicated by the original ones, the consequence is, that every Chinese letter is actually significant, and that it still retains its significancy, though connected with others. Accordingly the word *tsai*, which imports "misfortune, calamity," is composed of the letter *mien*, "a house," and the letter *ho*, "fire;" so that the symbolical character for misfortune is the figure of a house on fire. The Chinese characters, then, are not simple letters without any signification, like those of the Europeans and other Asiatics; but when they are joined together, they are so many hieroglyphics, which form images and express thoughts.

Upon the whole, the original characters of the Chinese were real pictures (see Section of the *Egyptian* language); the next improvement was the symbolical character; the third and last stage is the present mode, in which artificial signs have been fabricated, in order to represent such thoughts or ideas as could not be represented by one or other of the methods above described. Du Halde, vol. ii. p. 400, *et seq.* has furnished us with rules for pronouncing the Chinese vowels and consonants; a piece of information which, we apprehend, would be of little consequence to our readers, and which we shall therefore pass over, and proceed to give a brief account of their grammar. As the whole language is composed of monosyllables, and these indeclinable, its grammatical structure must be simple and obvious: we shall only mention what to us appears singular and important.

120 Peculiarities of the Chinese parts of speech. In the Chinese language there is no diversity of genders or cases, and of consequence no declensions. Very often the noun is not distinguished from the verb; and the same word which in one situation is a substantive, in another may become an adjective, and even a verb.

The adjective always goes before the substantive; but if it follow it, it becomes a substantive.

The cases and numbers are known only by the composition. The plural number is distinguished by the particle *men*, which is common to all nouns; but when the noun is preceded by some word that signifies number, the particle *men* is not annexed.

The Chinese genitive, both singular and plural, when it comes after nouns, is often made by *ti;* and there is no other case in that language. The same particle is sometimes placed after pronouns, as if they were derivatives.

The comparative degree is formed by adding the particle *keng*, which is always set before the noun, and signifies *much*. The particle *to* is sometimes used, which likewise imports *much*.

The Chinese have only three personal pronouns, *nqo*, "I," *ni*, "thou," and *ta*, "he:" these become plural by adding the syllable *men*. They are made possessive by adding the syllable *ti*, as *nqo ti*, "mine," *ni ti*, "thine," *ta ti*, "his." The patronymics are formed by putting the name of the city, country, &c. after the pronoun: *chon* is the pronoun relative *who*, *what*, *which*.

Chinese verbs have only three tenses, the preterperfect, the present, and the future. When there is no particle added to the verb, it is the present: the preterperfect is made by adding the particle *leao:* to distinguish the future tense they use the particle *tsiang* or *hoei*; and these are all the varieties incident to their verbs.

The Chinese language has no words that are properly adverbs; they only become so by custom, or by the place they possess in discourse. They are often obliged to employ several words to express the adverbs of other languages: they have none that are demonstrative, or proper for calling or exhorting; but in their stead they are obliged to use nouns and verbs.

121 Their numerals. Perhaps our readers may wish to know the Chinese numerals; and may imagine that they bear a resemblance to those of the European or other Asiatic dialects. In this, however, they will be disappointed.

They stand as follows:

Y	One
Eut	Two
San	Three
Sace	Four
Ou	Five
Lou	Six
Tsi	Seven
Po	Eight
Kieou	Nine
Che	Ten
Che y	Eleven
Eut che	Twelve
San che	Thirteen
Pe	One hundred
Eut pe	Two hundred
Y tsien	One thousand
Y ouan	Ten thousand
Che ouan	Twenty thousand
Eut ouan	One hundred thousand
Che ouan	Two hundred thousand
Y pe ouan	One million

There are a great many particles proper to numbers in the Chinese language: they are frequently used, and in a way peculiar to it; for every numeral has a particle importing the object to which it is attached. Thus *co* is used for man, and *y co* for a woman, &c.; *hoei* is used for illustrious men; *tche* or *tchi* is used for ships, dogs, hens; *mey* is used for pearls and precious things; *pen* is used for books; *teng* is appropriated to oxen and cows; *too* is used for letters and little bundles of paper; *oo* is employed for corn and pulse. Those distinctions indicate a language manufactured on purpose to be employed by people who were too high and too haughty to converse with the vulgar.

122 Style of the Chinese writers.

The style of the Chinese, in their elaborate compositions, is mysterious, concise, and allegorical, after the eastern manner. It is often obscure to those who do not understand the language thoroughly; and it requires a considerable degree of skill to avoid mistakes in reading an author of elegance and sublimity. Their writers express a great deal in few words; and their expressions are lively, full of spirit, intermingled with bold comparisons and lofty metaphors. They affect to insert in their compositions many sentences borrowed from their five canonical books; and as they compare their books to pictures, so they liken these quotations to the five principal colours employed in painting; and in this their eloquence chiefly consists.

They prefer a beautiful character to the most finished picture; and nothing is more common than to see a single page covered with old characters, if they happen to be fair and elegant, sold at a very high price. They honour their characters in the most common books; and when they happen to light by chance upon a printed leaf, they gather it up with the greatest care and respect.

In China there are three varieties of language; that of the common people, that of the people of fashion, and that employed in writing books. Though the first is not so elegant as either of the other two, it is not however inferior to our European languages; though those who are but superficially acquainted with the Chinese may, in fact, imagine it uncouth and barbarous. This low and rude language is pronounced and written many different ways, as is generally the case in other countries.

But a more polished, and at the same time a much more energetic, language, is employed in an almost infinite number of novels; some perhaps true, but many more the vehicles of fiction. These are replete with lively descriptions, characters highly finished, morality, variety, wit, and vivacity, in such a degree as to equal in purity and politeness the most celebrated authors of Europe. This was the language of the Mandarins; and though exquisitely beautiful in its kind, was still inferior to the language of books. This last might be styled the *hypersublime;* and of this there are several degrees and intervals before an author can arrive at what they call the language of the *king*. This mode of writing cannot be well understood without looking upon the letters; but when understood, it appears easy and flowing. Each thought is generally expressed in four or six characters: nothing occurs that can offend the nicest ear; and the variety of the accents with which it is pronounced produces a soft and harmonious sound.

The difference between the *king* and their other books consists in the difference of the subjects upon which they are written. Those of the former are always grand and sublime, and of course the style is noble and elevated: those of the latter approach nearer to the common affairs and events of life, and are of consequence detailed in the Mandarin tongue. In writing on sublime subjects no punctuations are used. As these compositions are intended for the learned only, the author leaves to the reader to determine where the sense is complete; and those who are well skilled in the language readily find it out.

The copiousness of the Chinese language is in a great measure owing to the multitude of its characters. It is likewise occasioned, in some degree, by the difference of their signification, as also by the artificial method of their conjunction, which is performed most commonly by uniting them two and two, frequently three and three, and sometimes four and four.

123 Their books numerous and bulky.

Their books are very numerous and bulky, and of course exceeding cumbrous. A dictionary of their language was compiled in the 18th century. It consisted of 95 large volumes. An appendix was annexed of 25 volumes. Their other books are voluminous in proportion. The Chinese, one may say, are a nation of learned men. Few people of rank neglect the belles lettres; for ignorance in a man of any degree of eminence is deemed an indelible stain on his character.

For their manner of writing, the implements with which they write, and the materials upon which they draw their characters, we must refer our readers to the article WRITING. It would, we believe, afford our readers some pleasure, could we discover and explain the reasons which have hitherto prevented the Chinese from adopting the letters employed from time immemorial by the other nations of Europe and Asia.

124 Obstacles to their improvement in science and literature.

The Chinese have ever looked upon themselves as greatly superior to the rest of mankind. In ancient times they entertained such contemptible notions of foreigners, that they scorned to have any further commerce with them than to receive their homage. They were indeed, at a very early period, highly revered by the Indians, Persians, and Tartars. In consequence of this veneration, they looked upon themselves as the favourites of heaven. They imagined they were situated in the middle of the earth, in a kind of paradise, in order to give laws to the rest of mankind. Other men they looked upon with contempt and disdain, and deemed them deformed in body and defective in mind, cast out into the remote corners of the world as the dross and refuse of nature. They boasted that themselves only had received from God rational souls and beautiful bodies, in order to qualify them for being sovereigns of the species.

Such are the sentiments of the Chinese; and with such sentiments it is by no means surprising that their improvements in *language*, in *writing*, and other appendages of the belles lettres, have not been proportioned to their progress in mechanics. When people are once fully persuaded that they have already arrived at the summit of perfection, it is natural for them to sit down contented, and solace themselves with the idea of their own superior attainments. The Chinese had early entertained an exalted opinion of their own superiority to the rest of mankind; and therefore imagined that they had already carried their inventions to the *ne plus ultra* of perfection; the consequence was, that they could make no exertions to carry them higher.

The Chinese, for the space of 3000 years, had almost no intercourse with the rest of mankind. This was the consequence of their insulated situation.—They of course, *compared themselves with themselves;* and finding that they excelled all their barbarian neighbours,

bours, they readily entertained an opinion that they excelled all the rest of mankind in an equal proportion. This conceit at once stifled the emotions of ambition, and deprived them of all opportunities of learning what was going forward in other parts of the world.

They despised every other nation. People are little disposed to imitate those whom they despise; and this perhaps may be one reason why they are at this day so averse from adopting the European inventions.

A superstitious attachment to the customs of the ancients, is the general character of the Asiatic nations. This is evidently a kind of diacritical feature among the Chinese. The institutions of *Fohi* are looked up to among them with equal veneration as those of *Thoth* were among the Egyptians. Among the latter, there was a law which made it capital to introduce any innovation into the music, painting, or statuary art, instituted by that legislator. We hear of no such law among the former; but custom established, and that invariably, for a space of 3000 years, might operate as forcibly among them as a positive law did among the people first mentioned. An attachment to ancient customs is often more powerful and more coercive than any law that can be promulgated and enforced by mere human authority. These reasons, we think, may be assigned as the impediments to the progress of the Chinese in the belles lettres, and perhaps in the cultivation of the other sciences.

125 Chinese words found in various other languages.

Though the language of the Chinese is confessedly different from all the other known languages in its character and construction, it contains, however, a great number of words evidently of the same origin with those which occur in other dialects, used by people, who, according to the natural course of things, could never have been connected with that remote country. A few of those we shall produce before we conclude this section. We shall begin with the import of the name *China*.

China, or, as the orientals write it, *Sin*, is perhaps the Latin *sinus*, "the bosom, the heart, the middle." The Chinese actually imagine that their country is situated in the very middle of the earth, and of consequence call it *Cham*, "the middle, the heart;" a denomination which exactly suits their opinion.

Tu, in Chinese, intimates every thing that falls under the cognizance of the senses, every thing that strikes the sight; in Latin, *tueor*.

Ta, a table, a plank, a figure that renders every thing sensible: 2. To see, to look upon, to appear; Greek ταω τανω, whence τεινω, *tendo*.

Tue, to examine attentively, to inspect carefully.

Tui, the most apparent, chief, principal, first; 2. Lightning, thunder.

Teu, a sign by which we know one, letter of acknowledgment. All these ideas are contained in the Hebrew תו, *thu*, *signum*, which we believe has produced the Egyptian *thouth*, the god or godlike man who invented letters, geometry, music, astronomy, &c.

Tai, a dye, a theatre; Greek of old Θεαω, then Θεαομαι, "to see, to look."

Tam, Latin *tantum*, "so much."

Tan, land, country, region, a syllable annexed to the end of a great number of words. *Aqui tan*, *Aquitania*, "a land of water;" *Mauri tan*, *Mauritania*, "the land of the Moors." The orientals prefix *s*, whence *Farsi stan*, *Farsistan*, "the land or country of the Persians:" *Chusi stan*, *Chusistan*, "the country of Chuz;" *Turque stan*, *Turquestan*, "the land of the Turks."

Ti, a chief, an emperor, a title of dignity; whence the Greek τιω, "to honour;" hence, too, the word *di*, "bright, glorious;" whence Δις, "Jupiter," "Διος, divine;" the Latin *Dius*, now *Deus*, "God," and *Divus*, with the *digamma Æolicum* inserted; the Celtic *Dhia*, &c. It signified originally "bright, glorious," and was an epithet of the Sun.

Tum, Latin *tumeo*, "to swell."

Liven, "to love;" Hebrew לב, *leb*, "the heart;" Latin, *libet*. This word pervades all the dialects of the Gothic tongue, still retaining either the same or a nearly analogous signification.

Li, "letters;" Latin, *lino*, "to daub," as the Chinese actually do in forming their letters.

Lo, "to contain, that which contains;" Celtic, *log*; French, *loge*, *logis*, *loger*.

Lim, "a rule;" hence Latin, *linea*, "a line."

Su, "with;" Greek, συν, "with;" Celtic, *cyn*, *cym*; whence Latin, *cum*, *con*, &c.

Xim, "very high, elevated, sacred, perfect;" Latin, *eximius*.

Sin, "the heart;" Persian, *Sin*, "the heart."

Sien, "chief, first;" Celtic, *can*, *cean*, *san*, "the head;" metaphorically, the chief, the first, the principal; Thibet, *sen*, or *ken*, "great, elevated;" Arabic, *same*, "to be elevated or raised."

Sim, or *Sing*, "a constellation, a star, an element;" Hebrew, *shem*: Greek, σημειον, σημα; Latin, *signum*.

Sie, "a man of learning;" Goth. Sax. Engl. "see; to see, seer."

Cem, "a priest:" Hebr. *cohen*; Syr. *con*; Egypt. *can*, *cun*.

Quin, "a king;" Celtic, *ken*, *kend*, "head, chief;" Gothic, *koanig*; Germ. Flem. Engl. *king*, also *queen*.

Hu, "a door;" Goth. Germ. Engl. *hus*, *hausen*, *house*.

Min, "a river;" Welch, *men*, "the water of a river;" Latin, *mano*, "to flow," and perhaps *amoenus*, "pleasant."

Hen, "hatred;" Greek, αινος, "cruel, horrible, odious."

Kiven, "a dog;" Greek κυων, *id.*

Ven, "beauty;" Latin, *Venus*, *venustas*; Iceland. Swed. *wen*, "pleasant;" Scotch, *winsome*.

Han, "the soul, breath;" Greek, ανεμος; Latin, *anima*, *animus*.

To these instances of the analogy between the Chinese language and those of the other people of Asia and Europe many more might be added; but the preceding, it is hoped, will serve as a specimen, which is all that can be expected from an inquiry of the nature of the present.

Sect. VII. *Of the Greek Language.*

126 Origin of the Greeks

Before we enter upon the consideration of the essential and constituent parts of this noble language, we must beg leave to settle a few preliminaries, which, we trust,

trust, will serve to throw some light upon many points which may come under consideration in the course of the following disquisition.

The Greeks, according to the most authentic accounts, were descended of Javan or Jon, the fourth son of Japhet, the eldest son of the patriarch Noah. The Scriptures of old, and all the orientals to this day, call the Greeks *Jonim*, or *Jaunam*, or *Javenoth.* We have already observed, in the beginning of the article concerning the Hebrew language, that only a few of the descendants of Ham, and the most profligate of the posterity of Shem and Japhet, were concerned in building the tower of Babel. We shall not now resume the arguments then collected in support of that position; but proceed to investigate the character of that branch of the posterity of Javan which inhabited Greece and the neighbouring regions.

At what period the colonists arrived in these parts cannot be certainly determined; nor is it of great importance in the question before us. That they carried along with them into their new settlements the language of Noah and his family, is, we think, a point that cannot be controverted. We have endeavoured to prove that the Hebrew, or at least one or other of its sister-dialects, was the primæval language of mankind. The Hebrew, then, or one of its cognate branches, was the original dialect of the Jonim or Greeks.

Be that as it may, before these people make their appearance in profane history, their language deviates very widely from this original archetype. By what means, at what period, and in what length of time this change was introduced, is, we believe, a matter not easy to be elucidated. That it was progressive, is abundantly certain both from the rules of analogy and reason.

127 who were long a barbarous people.

The colonies, which traversed a large tract of country before they arrived at their destined settlements, must have struggled with numberless difficulties in the course of their peregrinations. The earth, during the period which immediately succeeded the universal deluge, must have been covered with forests, intersected with swamps, lakes, rivers, and numberless other impediments. As the necessaries, and a few of the conveniences of life, will always engross the first cares of mankind, the procuring of these comforts will, of necessity, exclude all concern about arts and sciences which are unconnected with these pursuits. Hence we think it probable, that most of those colonies which migrated to a very great distance from the plains of Shinar, which we believe to have been the original seat of mankind, in a great measure neglected the practice of the polite but unnecessary modes of civilization which their ancestors were acquainted with, and practised before the era of their migration. Certain it is, that those nations which continued to reside in the neighbourhood of that centre of civilization, always appear in a cultivated state; while, at the same time, the colonists who removed to a considerable distance appear to have sunk into barbarism, at a period more early than the annals of profane history can reach.—This appears to have been the situation of the primary inhabitants of Greece. Their own historians, the most partial to their own countrymen that can well be imagined, exhibit a very unpromising picture of their earliest progenitors. Diodorus Siculus, in delineating the character of the original men, we believe sketches his draught from the first inhabitants of Greece *. He represents them as absolute savages, going out in small parties to make war upon the wild beasts of the field, which (according to him) kept them in continual alarm. "Necessity obliged them to band together for their mutual security; they had not sagacity enough to distinguish between the wholesome and poisonous vegetables; nor had they skill enough to lay up and preserve the fruits of autumn for their subsistence during the winter." The scholiast on Pindar describes the situation of the inhabitants of Peloponnesus in the following manner†. "Now some have affirmed that the nymphs, who officiated in performing the sacred rites, were called *Melissæ*. Of these Mnaseas of Patara gives the following account. They prevailed upon men to relinquish the abominable practice of eating raw flesh torn from living animals, and persuaded them to use the fruits of trees for food.—Melissa, one of them, having discovered bee-hives, ate of the honey-combs, mingled the honey with water for drink, and taught the other nymphs to use the same beverage. She called bees Μελισσαι, *Melissæ*, from her own name, and bestowed much care on the management of them.

* Lib. i.

† *Pythen.* Ode 4.

128 Progress of their civilization.

"These things (says he) happened in Peloponnesus; nor is the temple of Ceres honoured without nymphs, because they first pointed out the mode of living on the fruits of the earth, and put an end to the barbarous practice of feeding on human flesh. The same ladies, too, from a sense of decency, invented garments made of the bark of trees."

Hecatæus the Milesian, treating of the Peloponnesians, affirms*, "that before the arrival of the Hellenes, a race of barbarians inhabited that region; and that almost all Greece was, in ancient times, inhabited by barbarians†. In the earliest times (says Pausanias) (o) barbarians inhabited most part of the country called *Hellas.*" The original Greeks, if we may believe an author of deep research and superior ingenuity ‡, were strangers to all the most useful inventions of life. Even the use of fire was unknown till it was found out and communicated by Prometheus, who is thought to have been one of the first civilizers of mankind. Hence Æschylus §, introduces Prometheus commemorating the benefits which he had conferred upon mankind by his inventions, in a strain that indicates the uncultivated state of the world prior to the age in which he flourished. For the entertainment of our readers, we shall translate as much of that passage as suits our present purpose.

* *Strabo*, lib. vii.

† *Id.* lib. i.

‡ *Plin. Nat. Hist.*

§ *Prometh.* verse 441.

——————"Of the human race
Now hear the tale, how foolish erst they were:
I taught them thought and exercise of reason:
If aught they saw before, they saw in vain.
Hearing, they heard not; all was shapeless dreams
For a long space of time, at random mixt.

(o) The Greeks borrowed this contemptuous epithet from the Egyptians. See *Herod.* lib. ii. cap. 158.

In wild confusion: for they neither knew
Tile-cover'd houses standing in the sun,
Nor timber work; but, like the earth-bred ant,
They lodg'd in sunless caves dug under ground:
No certain sign had they of winter cold,
Nor of the flow'ry spring, or summer store,
But blindly manag'd all; till I them taught
What time the stars appear, what time they set,
Hard to be scan'd: then arithmetic rare,
That queen of arts, by dint of patient thought
Descry'd, I taught them; and how vocal sounds
From letters join'd arose."

This character, though applied to mankind in general, was in reality that of the most ancient Greeks. These forbidding features had been transmitted to the poet by tradition as those of his ancestors: he was a Greek, and of consequence imputes them to all mankind without distinction.

Phoroneus, the son and successor of Inachus*, is said to have civilized the Argives, and to have taught them the use of some new inventions. This circumstance raised his character so high among the savage aborigines of the country, that succeeding ages † deemed him the first of men. Pelasgus obtained the like character, because he taught the Arcadians to live upon the fruit of the *fagus*, to build sheds to shelter them from the cold, and to make garments of the skins of swine.

But what clearly demonstrates the unpolished character of the most ancient Greeks is, the extravagant honours lavished by them upon the inventors of useful and ingenious arts. Most of these were advanced to divine honours, and became the objects of religious worship to succeeding generations. The family of the Titans affords a most striking instance of this species of adulation. Jupiter, Juno, Mars, Apollo, Venus, Diana, &c. were sprung of this family. By the useful inventions which these personages communicated to the uncultivated nations of Greece, they obtained such lasting and such extravagant honours, that they justled out the sidereal divinities of the country, and possessed their high rank as long as Paganism prevailed in those regions. To these testimonies of the savagism of the original Greeks, others almost without number might be added; but those adduced in the preceding part of this inquiry will, we hope, satisfy every candid reader as to the truth of the position advanced.

129
A new colony arrives in Greece called *Pelasgi*.

While matters were in this situation with respect to the primitive Jonim or Greeks, a new colony arrived in those parts, which in a few years considerably changed the face of affairs. The people who composed this colony were called *Pelasgi;* concerning whose origin, country, character, and adventures, much has been written, and many different opinions exhibited by the learned. It is not our province to enter into a detail of their arguments and systems; we shall only inform our readers, that the general opinion is, that they were natives either of Egypt or Phœnicia. We have seen a dissertation in manuscript upon this subject, from which we are allowed to extract the following particulars.

The author, we think, has proved by very plausible arguments, that these people could not be descendants of the Egyptians nor Phœnicians. He maintains, that the Pelasgi were a great and numerous tribe; that they overspread all the coast of Asia Minor from Mount Mycale to Troas; that they were masters at one time of all the Asiatic and Grecian islands; that they overran Greece and many of the neighbouring countries; and all this in less than half a century.—These facts he seems to have proved from Homer, Herodotus, Diodorus Siculus, Pausanias, and other Greek authors of approved authenticity. He shows, that they were a civilized generation; that they were well acquainted with military affairs, legislation, agriculture, navigation, architecture, letters, &c. He insists, that Phœnicia could not at any given period have furnished such a numerous body of emigrants, even supposing the whole nation had emigrated, and left their native country a desart. He believes that this event took place before the invasion of Canaan by the Israelites; that consequently the Pelasgic migration was not occasioned by that catastrophe. He has shown, we think by very probable arguments, that the Egyptians in the earliest ages were averse to foreign expeditions, especially by sea; because that people hated this element, and besides could be under no temptation to emigrate: add to this, they were accustomed to live on small matters, and their country was exceedingly fertile and easily cultivated. It appears (says he) from Herodotus, that the Pelasgi were not acquainted with the religion of the Zabians, which could not have been the case had they emigrated from either of these countries. He makes it appear, at least to our satisfaction, that Herodotus is mistaken when he supposes that the deities of Greece were derived from Egypt. He demonstrates, that the names of the greatest part of those deities are of Phœnician extraction; and this opinion he establishes by a very plausible etymological deduction. He asserts, that had the Pelasgi been natives of either of the countries above mentioned, it would be absurd to suppose them ignorant of the names and religious rites of their respective nations. He finds, that the Egyptian and Phœnician colonies, which afterwards settled in Greece, were enemies to the Pelasgi, and either subdued or expelled them the country, which, he imagines, would scarce have been the case had both parties sprung from the same ancestors. After settling these points, he concludes, that the people in question were the progeny of the Arabian shepherds, who, at a very early period, invaded and subdued both the Lower and Upper Egypt. After possessing that country about a century and a half, they were conquered by Amenophis king of the Upper Egypt, who drove them out of the country. Upon this the fugitives retired to Palestine, where Manetho the Egyptian historian loses sight of them, and either through malice or ignorance confounds them with the Israelites. This writer supposes that those fugitives gradually directed their course for the west and north-west coasts of Asia Minor, whence they conveyed themselves over to Greece.

Such are the arguments by which the author of the dissertation above mentioned supports his hypothesis. It is, for aught we know, altogether new, and to us it appears by no means improbable. If our curious readers should wish to know more of this subject, they may consult Gebelin's preliminary Discourse to his Greek Dictionary, Lord Monboddo's Inquiry into the Origin and Progress of Language, vol. i. towards the end, and Mr Bryant's Analysis of Ancient Mythology, *passim*.

Be this as it may, nothing is more certain than that the Pelasgi were the first people who in some degree civilized the savages of ancient Greece. It is not our business at present to enumerate the many useful inventions which they communicated to the Greeks, at that time worse than barbarians. We deem it, however, absolutely necessary, as an introduction to our subject, to hazard a few conjectures on the language and letters of those adventurers; a point strictly connected with the subject soon to fall under consideration.

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* Plato.

† Pausan. lib. viii. c. 1.

130
Who introduce letters into that country.

Whether we suppose the Pelasgi to have been the offspring of the Phœnicians, Egyptians, or Arabian shepherds, it will make little difference as to their language; every man of learning and research is convinced that those three nations, especially at that early period, spoke a dialect of the Hebrew. The Pelasgi, then, must have spoken a dialect of that language when they arrived in Greece. Perhaps it might have undergone several changes, and acquired some new modifications, during so many years as had passed since they began to be a separate nation, and in the course of so many peregrinations. Some monuments of theirs still extant prove this fact beyond all contradiction. As these people incorporated with the aborigines of Greece, the remains of the original language of mankind, or at least so much of it as had been retained by them, gradually coalesced with that of the new settlers. From this, we think, it is obvious, that prior to the arrival of the new colonists from the East, the language now current among the two united tribes must have been a dialect of the Phœnician, Arabian, Hebrew, &c. Be that as it may, Herodotus * affirms that the Pelasgi in his time spoke a barbarous language, quite unintelligible to the modern Greeks.

The reason of this difference between the language of the Hellenes or Greeks in the age of Herodotus, and that of the remains of the Pelasgi at that period, seems to be this: Prior to the time of that historian, the Greek language had, from time to time, undergone many changes, and received vast improvements; whereas, on the contrary, that of the remnant of the Pelasgi, who were now reduced to a very low state, had remained stationary, and was then just in the same predicament in which it had been perhaps a century after their arrival in the country.

As the Pelasgi, as was observed above, were a people highly civilized and well instructed in the various arts at that time known in the eastern world, they were skilled in agriculture, architecture, music, &c. (P). The presumption then is that they could not be unacquainted with alphabetical writing. This most useful art was well known in the countries from which they emigrated; and of course it is impossible to imagine that they did not export this art as well as the others above-mentioned. Diodorus Siculus imagines that † the Pelasgi knew not the use of alphabetical letters, but that they received them from Cadmus and his Phœnician followers; that those letters were afterwards called *Pelasgic*, because the Pelasgi were the first people of Greece who adopted them. This account must go to the score of national vanity, since very soon after he acknowledges ‡ that Linus wrote the exploits of the first Bacchus and several other romantic fables in Pelasgic characters; and that Orpheus, and Pronapides the master of Homer, employed the same kind of letters. Zenobius likewise informs us † that Cadmus slew Linus for teaching characters different from his. These letters could be none other than the Pelasgic ‡.

Pausanias, in his Attics, relates ‖, that he himself saw an inscription upon the tomb of Corœbus, who lived at the time when Crotopus, who was contemporary with Deucalion, was king of the Argives. This inscription then was prior to the arrival of Cadmus; and consequently letters were known in Greece before they were introduced by this chief. It likewise appears from Herodotus himself, that the Ionians were in possession of alphabetical characters before the coming of the Phœnicians. "For (says he) § the Ionians having received letters from the Phœnicians, changing the figure and sound of some of them, ranged them with their own, and in this manner continued to use them afterwards." If, then, the Ionians (Q) ranged the Phœnician characters with their own, it is obvious that they had alphabetical characters of their own.

Besides these historical proofs of the existence of Pelasgic characters, monuments bearing inscriptions in the same letters have been discovered in several parts of Greece and Italy, which place this point beyond the reach of controversy. What characters these were may be easily determined. As the Pelasgi emigrated from Arabia, the presumption is that their letters were Phœnician. They are said by Dr Swinton to have been 13 in number, whereas the Phœnician alphabet consists of 16. The three additional letters were probably invented by the latter people after the Pelasgi had left the eastern quarters. The Phœnician letters imported by the Pelasgi were, no doubt, of a coarse and clumsy contexture, unfavourable to expedition in writing, and unpleasant to the sight. Besides, the Phœnician characters had not as yet received their names; and accordingly the Romans, who derived their letters from the Arcadian Pelasgi †, had no names for theirs. The probability is, that prior to this era the Pelasgic letters had not been distinguished by names. These were of course no other than the original letters of the Phœnicians in their first uncouth and irregular form: and for this reason they easily gave way to the Cadmean, which were more beautiful, more regular, and better adapted to expedition. Plate XV.

Hitherto we have seen the Pelasgi and the Ionim incorporated, living under the same laws, speaking the same language, and using the same letters. But another nation, and one too of vast extent and populousness, had at an early period taken possession of a considerable part of the country afterwards distinguished by the name of *Hellas* or *Greece*. The Thracians were a great and mighty nation; inferior to none except the Indians ‡, says the father of Grecian history. These people at a very early period, had extended their quarters over all the northern parts of that country. They were, in ancient times, a learned and polished nation. From them, in

131
The Thracians a powerful nation at a very early period.

* Lib. i. cap. 59.

† Lib. iii.

‡ Ibid.

† *Apud Dr Gregory Sharp's Strict Greek Language*

‡ See Plate XVI.

‖ Lib. i. cap. 49.

§ Lib. i. c. 58.

† *Livii*, lib. i. c. 7.

‡ *Herod.* lib. v. c. 3.

(P) The Arcadians, who were a Pelasgic tribe, were highly celebrated for their skill in music. They introduced this art into Italy. See *Dion. Halicar.* lib. i.

(Q) The Athenians were originally called *Ionians*.

in succeeding ages, the Greeks learned many useful and ornamental sciences. Orpheus (R) the musician, the legislator, the poet, the philosopher, and the divine, is known to have been of Thracian extraction. Thamyris and Linus were his disciples, and highly respected among the Greeks for their learning and ingenuity. That these people spoke the same language with the Greeks, is abundantly evident from the connection between them and these Thracian bards. The Thracian language, then, whatever it was, contributed in a great proportion towards forming that of the Greeks. From the remains of the Thracian dialect there appears to have been a very strong resemblance between it and the Chaldean. This position we could readily support by the most plausible etymological deduction, did the limits prescribed us in this article admit such an inquiry. It appears, however, that the * Thracians, Getæ, and Daci or Davi, spoke nearly the same language. The Goths, so much celebrated in the annals of the lower empire, were the descendants of the Getæ and Daci, and consequently retained the dialect of their ancestors. The reader, therefore, must not be surprised, if in tracing the materials of which the Greek language is composed, we should sometimes have recourse to the remains of the Gothic.

* *Strabo*, lib. i. & vii.

131
The Greek language composed of three different dialects.

We have now found out three branches of the Greek language; that of the Ionim or *Aborigines*, that of the Pelasgic tribe, and that of the Thracians. These three, we imagine, were only different dialects of the very same original tongue. This assertion we could readily prove by the comparison of a great number of words taken from the two last, were this a proper place for such a discussion.

132
Arrival of Cadmus in Greece.

Some centuries after the arrival of the Pelasgi, Cadmus, an Egyptian (S) by birth, and a sojourner in Phœnicia, arrived in Bœotia with a multitude of followers. This colony-chief and his countrymen introduced letters and several other useful improvements into the country in question. As these people were natives of Phœnicia and its environs, their alphabet was that of their native country, consisting of 16 letters. That the Phœnician alphabet was nearly the same with the Samaritan and Hebrew, has been so often and so clearly demonstrated by the learned of this and the former century, that it would be altogether superfluous to insist upon it in this short inquiry. The Phœnicians, as is generally known, wrote from right to left, and the old Grecian characters, inverted, exactly resemble the other.

133
The letters introduced by him.

The names of the Cadmean characters are Syrian †, which shows the near resemblance between that language and the Phœnician. They stand thus: *alpha*, *beta*, *gamla*, *delta*, &c. The Syrians used to add *a* to the Hebrew vocables; hence alph becomes alpha, beth, betha or beta, &c. In the Cadmean alphabet we find the vowel letters, which is an infallible proof that this was the practice of the Phœnicians in the age of Cadmus; and this very circumstance furnishes a presumption that the Jews did the same at the same period.

† *Scaliger*.

After all, it is evident that the oldest Greek letters, which are written from right to left, differ very little from those of the Pelasgi. The four double letters θ, φ, ξ, χ, are said to have been added by Palamedes about 20 years before the war of Troy. Simonides is generally supposed to have added the letters ζ, η, ψ, though it appears by some ancient inscriptions that some of these letters were used before the days of Palamedes and Simonides.

In the year of our Lord 1456 seven brazen tables were discovered at Engubium, a city of Umbria in the Apennines, of which five were written in Pelasgic or Etruscoan characters and two in Latin. The first of these tables is thought to have been composed about 168 years after the taking of Troy, or 1206 years before Christ. By comparing the inscription on these tables with the old Ionic characters, the curious have been enabled to discover the resemblance.

134
The old Ionic character.

The old Ionic character wrote from right to left continued in general use for several centuries: It was composed of the Cadmean and Pelasgic characters, with some variations of form, position, and sound. The Athenians continued to use this character till the year of Rome 350. The old Ionic was gradually improved into the new, and this quickly became the reigning mode. After the old Ionic was laid aside, the * (Βουστροφηδον) Bustrophodon came into custom, which goes backwards and forwards as the ox does with the plough. They carried the line forward from the left, and then back to the right. The words were all placed close together, and few small letters were used before the fourth century. If our curious readers would wish to know more of letters and alphabets, we must remit them to Chishul, Morton, Postellus, the great Montfaucon, Gebelin, Astle, &c. For our part we are chiefly concerned at present with the Phœnician and Cadmean systems; and on these perhaps we may have dwelt too long.

* *Pausan.* lib. viii. cap. 17.

135
The Greek alphabet derived from the Phœnician.

Having now, we hope sufficiently proved that the Greek alphabet was derived from the Phœnician, in order to convince our curious but illiterate readers of the certainty of our position, as it were by ocular demonstration, we shall annex a scheme of both alphabets, to which we shall subjoin some strictures upon such letters of the Greek alphabet as admit any ambiguity in their nature and application.

A, *alpha*, had two sounds, the one broad like *a* in the English word *all*; the other slender, as *e* in *end*, *spend*, *defend*. The Hebrews certainly used it so, because they had no other letter to express that sound; the Arabs actually call the first of their alphabet *elif*; and they as well as the Phœnicians employ that letter to express both the sound of A and E promiscuously. The Greeks call their letter E ε-ψιλον, that is E slender, which seems to have been introduced to supply the place of A slender.

H, *eta*, was originally the mark of the *spiritus asper*, and no doubt answered to the Hebrew ה. It is still retained in that capacity in the word Ηεκατον, and in words with the *spiritus asper* beginning books, chapters, sections,

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(R) Orpheus seems to be compounded of two oriental words, *or*, "light," and *phi*, "the mouth." Though some deduce it from the Arabian *arif*, a learned man."

(S) Joseph Scaliger's account of the origin of the Ionic letters. *Euseb. Chron.*

tions, &c. Ε originally marked both the sound of Εψιλον and Ητα; that is, it was sometimes sounded short as at present, and sometimes long, where it is now supplied by Η. As it was found convenient to distinguish these two different quantities of sound by different letters, they adopted Η, the former *spiritus asper*, to denote the long sound of Ε, and substituted the present *spiritus asper* [῾] in its place.

Ι, *iota*, is the Hebrew or Phœnician *jod* or *yod*. We imagine it originally served the purpose of both iota and ypsilon. It had two different sounds; the one broad and full, the other weak and slender. The latter had the sound of the modern υψιλον. That this was actually the case, appears in several monumental inscriptions: And upon this depends the variation of some cases of the demonstrative pronoun and of the second declension.

Ο, *omicron*, or small *o*, in the original Greek had three different sounds. It sounded *o* short, as at present; and likewise *o* long, now denoted by Ω or large *O*. It likewise marked the sound of the improper diphthong ου, sounded like the English diphthong *oo*. The Ω was taken from the Phœnician wau or *V*.

Υ, *ypsilon*, we have observed before, was adopted to supply a mark for the sound of I slender.

Ζ, *zeta*, is compounded of δς. Dion. Halic. however, informs us, that this letter should be pronounced σδ, according to the Doric plan.

Θ, *theta*, was not known in the old Greek. It is compounded of τ and the *spiritus asper*, both which were of old written separately thus ΤΗ.

Ξ, *xi*, is compounded of γς, κς, χς. These letters, too, were originally written separately.

Φ, *phi*. This letter is compounded of β, π, and the *spiritus asper*; thus ΒΗ, ΠΗ.

Χ, *chi*, like the foregoing, is compounded of γ, κ, and the *spiritus asper* as above.

Ψ, *psi*, like some of the rest, is made up of βς, πς, which, too, were originally written in separate characters.

These observations are thrown together purely for the use of students who may not choose to inquire into the *minutiæ*. We are sorry that the nature of the work will not permit us to extend our researches to greater length. The reader will find an ancient inscription on Plate CCCCXVI. in which the powers of the letters are exemplified as they were in the first stage of the Greek language. Every language, we believe, was originally composed of inflexible words; the variations which now distinguish nouns and verbs were the effects of progressive improvements. What might have been the state of the Greek language with respect to these variations in its original form, it is not now possible to discover. That it was rude and irregular, will not, we imagine, be controverted. One of the first attempts towards forming the variations, now denominated *declensions* and *conjugations*, would probably be made upon the *demonstrative* article and the *substantive* verb. This observation will be found to hold good in most polished languages. In the Greek tongue, this was evidently the method.

136
Origin and flexion of the article.

The original Greek article was imported from the east. It was the Hebrew or Phœnician ה *ha*. This particle sometimes signifies *one*, and sometimes it answers to our demonstrative *the;* both in its adverbial and demonstrative capacity it imports demonstration. In the earliest stages of the two oriental languages, it was probably written apart, as *ha-melech*, "the king." In process of time it came to be joined with the following word, as *Hammelech*. From this we think the Greek article was deduced. It is still retained in the Doric dialect in its pristine character. The difference between *ho* and *ha* in the eastern language is nothing. Here then we have the articles ὁ masculine and ἁ feminine. Upon these several changes were superinduced, in order to render them more useful for the purposes of language. For those changes we know of no archetype.

The Greeks then having adopted the Hebrew, or Phœnician, or Chaldean article *ha*, and changed it into *ho* for the masculine, seem to have arranged its variations in the following manner:

	Sing.	*Plu.*
Nom.	ὁ	ὁι
Gen.	ὁυ	ὁν
Dat.	ὁι	ὁις
Acc.	ὁν	ὁυς

137
Its use in the flexion of nouns of the first and second declensions.

In the earliest stages of the Greek language, ι and υ were sounded in the same manner, or nearly so, as was observed above. The accusative was at first like the nominative; for distinction's sake it was made to terminate in ν, which letter was likewise adopted to characterize the genitive plural; ς was annexed to the dative plural, to distinguish it from the dative singular. The radical word was still without inflexion.

When the article was inflected in this manner, the process stood as follows: we take λογος for an example.

	Sing.	*Plu.*
Nom.	ὁ λογ *speech*	ὁι λογ *speeches*
Gen.	ὁυ λογ *of speech*	ὁν λογ *of speeches*
Dat.	ὁι λογ *to speech*	ὁις λογ *to speeches*
Acc.	ὁν λογ *speech*	ὁυς λογ *speeches*

In this arrangement our readers will observe, that in the time under consideration, ω was not yet introduced; and therefore ομικρον or little ο was the same letter in the genitive plural as in the accusative singular; but in the latter case it was sounded long by way of distinction.

The article *ha*, which is still retained in the Doric dialect, was varied as follows:

	Sing.	*Plu.*
Nom.	ἁ	ἁι
Gen.	ἁς	ἁν
Dat.	ἁι	ἁις
Acc.	ἁν	ἁς

These variations differ a little from those of the masculine; and they were no doubt made for the sake of distinction, as is usual in such cases. We shall now give an example of the feminine as it must have stood before variations were introduced. We shall employ τιμη.

	Sing.	*Plu.*
Nom.	ἁ τιμ *honour*	ἁι τιμ *honours*
Gen.	ἁς τιμ *of honour*	ἁν τιμ *of honours*
Dat.	ἁι τιμ *to honour*	ἁις τιμ *to honours*
Acc.	ἁν τιμ *honour*	ἁς τιμ *honours*

Afterwards, when the Chaldean article *du* was adopted for the neuter gender, the letter ד or *d* was changed into τ, and prefixed to it; and then the Greeks, who, in their declension of adjectives, always followed the neuter gender, began to prefix it to the oblique cases.

In this manner we think the Greek nouns stood originally; the only change being made upon the article. At length, instead of prefixing that word, and expressing it by itself, they found it convenient to affix a fragment of it to the noun, and so to pronounce both with more expedition. Thus ὁς-λογ, e. g. became λογ-ὁς, ὁν λογ became λογ ον, and of course λογος and λογου, &c. The *spiritus asper*, or rough breathing, was thrown away, in order to facilitate the coalition. Nouns of the neuter gender, as was necessary, were distinguished by using ν instead of ς. In oriental words the Greeks often change ς into ν, and *vice versa*.

138 In this mode of flexion the Greeks copied from the Orientals.

In this case the Greeks seem to have copied from an eastern archetype. In Hebrew we find an arrangement exactly similar. To supply the place of the pronouns possessive, they affix fragments of the personals: Thus, they write *ben-i*, "my son," instead of *ben-ani*, and *debir-nu*, "our words," instead of *debir-anu*, &c. The persons of their verbs are formed in the same manner. In this way, in our opinion, the variations of the first and second declensions were produced.

139 Formation of the third declension and of its cases.

After that a considerable number of their nouns were arranged under these two classes, there remained an almost infinite number of others which could not conveniently be brought into these arrangements; because their terminations did not readily coalesce with the articles above mentioned. These, like nouns of the neuter gender, were in a manner secluded from the society of the two other classifications. It is probable that these for a long time continued indeclinable. At last, however, an effort was made to reduce them into a class as well as the others. All these excluded nouns originally terminated with ς, which appears from their genitives as they stand at present. By observing this case, we are readily conducted to the termination of the pristine vocable. The genitive always ends in ος, which ending is formed by inserting ο between the radical word and ς. By throwing out ο we have the ancient nominative: Thus, Τιταν, genitive Τιτανος; taking out ο we have Τιτανς, the original inflexible termination. Λητω, genitive Λητοος; throw out ο and you have Δητος. Παλλας, genitive Παλλαδος; take away ο and there remains παλλαδς. Ορνις, genitive Ορνιθος; by throwing out ο we have Ορνιθς. Αναξ, genitive Ανακτος, Ανακτς. Κρεατος, genitive Κρεατιος, Κρεατις; originally Κρεατος, because originally ι had the sound of η, as was observed above. Μελι, genitive Μελιτος, Μελιτς. Ειδος, genitive Ειδεος, Ειδες, the old noun. In short, the genitive is always formed by inserting ο immediately before ς, which is always the termination of the nominative; and by this rule, we easily discover the noun such as it was in its original form.

The dative of this declension was closed with ι *ascriptum*; the same with that of the second, namely, ι *subscriptum*. The accusative commonly terminates with α; but was originally ended with ν. The Romans imitated the Æolian dialect, and they commonly ended it with *em* or *im*. The Greeks, perhaps in this imitated their progenitors, for *a* was their favourite vowel. The nominative plural ended in ες, which nearly resembles the English plural, and was possibly borrowed from the Thracians. The genitive plural in all the declensions ends in ων; the dative ends in σι, the σ being inserted to distinguish it from the dative singular. When a strong consonant, which would not easily coalesce with ς, comes immediately before it, that consonant is thrown out to avoid a harsh or difficult sound. The sum then is; the cases of nouns of the first and second declensions consist of the radical word with fragments of the articles annexed, and these were the first classifications of nouns. The other nouns were left out for some time, and might be denominated *neuters*; at length they too were classified, and their variations formed as above. In this process the Greeks deviated from the oriental plan; for these people always declined their nouns by particles prefixed. Whether the Greeks were gainers by this new process, we will not pretend positively to determine. We are, however, inclined to imagine that they lost as much in perspicuity as they gained by variety.

140 Greek ablative.

It is generally believed that the Greeks have no ablative; to this opinion, however, we cannot assent. It is true, that the dative, and what we would call the *ablative*, are always the same: yet we think there is no more reason to believe that the latter is wanting in Greek, than that the ablative plural is wanting in Latin, because in that language both these cases are always alike.

141 Genders.

In the eastern languages there are only two genders, analogous to the established order of nature, where all animals are either male or female. But as the people of the east are, to this day, strongly addicted to personification, they ranged all objects of which they had occasion to speak, whether animate or inanimate, under one or other of these two classes. Hence arose what is now called the *masculine* and *feminine* genders. The orientals knew nothing of a neuter gender, because, indeed, all objects were comprehended under the foregoing classes. The Phœnician feminine was formed from the masculine, by adding את, *ah*. In this the Greeks in many cases imitated them. The Greeks and Latins left a vast number of substantives, like a kind of outcasts, without reducing them to any gender; this process gave rise to the neuter gender, which imports, that such substantives were of *neither gender*. This has the appearance of a defect, or rather a blemish, in both. Sometimes, too, they make words neuter, which, according to the analogy of grammar, ought to be either masculine or feminine. And again, they range words under the masculine or feminine, which by the same rule ought to have been neuter. In short, the doctrine of generical distribution seems to have been very little regarded by the fabricators of both tongues. The beauty which arises from variety seems to have been their only object.

142 Farther observations on the article.

The use of the article in the Greek language is, we think, rather indeterminate; it is often prefixed to proper names, where there is no need of demonstration nor generical distinction. On the contrary, it is often omitted in cases where both the one and the other seem to require its assistance. In short, in some cases it seems to be a mere expletive. Though both Lord Monboddo and Mr Harris have treated of this part of speech, neither the one nor the other has ascertained its proper use. (See *Origin and Progress of Language*, vol. ii. p. 53. *Hermes*, p. 214. *et seq.*)—We know not any objection to the early use of articles among the Greeks so plausible as the total neglect of them among the Romans. But it ought to be considered, that after the flexions were introduced, the use of the article was in a great measure neglected. Accordingly, Lord Monboddo observes that it is very seldom used as such by Homer, but commonly in place of the relative pronoun ὁς, ἡ, ὁ.—Thus it would appear, that at the time when the Roman language was reduced to the Grecian standard, the article was not commonly used by the Greeks; and of course the Latins never employed it. There can be no doubt but the pronoun *who*, in the northern languages, is the same with the Greek ὁ, and the Hebrew *hua*. This among the northern people is always a relative, which affords a presumption that the Greeks originally used the article in the same manner as we do at present. The fact is, that the articles having once got into vogue, were often positively used as mere expletives to fill up a gap; and that, on the other hand, when there was no occasion for pointing out an object, it being fully determined by the tenor of the discourse, it was often omitted.

143 Adjectives. In forming adjectives, they followed the same plan that they had done with substantives. Their great effort was to make their adjectives agree with their substantives in gender, number, and case. This arrangement improved the harmony of speech; and nothing could be more natural than to make the word expressing the quality correspond with the subject to which it belonged.

As adjectives denote qualities, and thus are susceptible of degrees, nature taught them to invent marks for expressing the difference of these degrees. The qualities may exceed or fall below each other by almost numberless proportions; it was, however, found convenient to restrict these increases and decreases to two denominations. The positive is, properly speaking, no degree of comparison at all; therefore we need only point out the formation of the comparative and superlative.

The former is generally thought to be fabricated, by first adding the Hebrew word יתר, *excellent*, to the positive, and then affixing the Greek termination ος; and the latter, by affixing the Syrian word *tath* and the syllable ος, in the same manner.

144 Greek numerals. Every nation, even the most uncivilized, have early acquired the notion of number. Numerical characters and names are the same in many different languages. These terms were discovered, and in use, long before grammar came to any perfection; and therefore remain either inflexible or irregular. The first way of computing among the Greeks was by the letters of the alphabet; so that Α signified *one* and Ω *twenty-four*: in this manner the rhapsodies of Homer are numbered; and so are the divisions of some of the Psalms, as is generally known. But a more artificial plan of computation was obviously necessary. They divided the letters of the alphabet into *decades* or tens, from Α to Ι≐10. To express the number 6, they inserted ϛ *baw*≐6; so that by this means the first decade amounted to 10. In the next decade every letter increased by tens, and so Ρ denoted 100. In this decade they inserted ϟ κοππα≐90. In the third, every letter rose by 100; so that ϡ σαμπι≐900. By inserting these three Phœnician characters they made their alphabet amount to 900. To express chiliads or thousands, they began with the letters of the alphabet as before; and to make the distinction, they placed a dot under each character, as the units, tens, hundreds, were distinguished by an acute accent over them.

But in monumental inscriptions, and in public instruments, a larger and more lasting numerical character was fabricated. The began with Ι, and repeated that letter till they arrived at Π=5. This is the first letter of πεντε, *five*. Then they proceeded, by repeating Ι till they came to 10 Δ, the first letter of δεκα, 10. Then they repeated Δ over and over, so that four Δ=40. To express 50, they used this method; they inclosed Δ in the belly of |Δ|=50, |Η|=500, |Μ|=50,000, &c. Often, however, Χ signifies 1000, and then we have δις Χιλιοι, 2000; τρεις Χιλιοι, 3000; and so of the rest.

145 Pronouns. The word *pronoun* signifies a word placed instead of a noun or name; and indeed the personal pronouns are really such: this needs no explication. The pronoun of the first person is one of those words which have continued invariable in all languages; and the other personals are of the same character. The relatives, possessives, demonstratives, and gentiles, are generally derived from these, as may be discerned by a very moderate adept in the language. Our readers will therefore, we hope, easily dispense with our dwelling upon this part of speech.

146 Greek verbs, how formed. *Verb*. In most ancient languages, verbs, according to the order of nature, have only three tenses or times, namely, the *past*, *present*, and *future*. The intermediate tenses were the invention of more refined ages.—The Greek, in the most early periods, had no other tenses but those above mentioned. The manner of forming these we shall endeavour to point out, without touching upon the nature of the rest, since an idea of them may be acquired from any common grammar.

We have observed above, that the flexion of nouns of the first and second declensions are formed by annexing fragments of the articles to the radical words; and that the variation of the tenses was produced by joining the substantive verb, according to the same analogy. Every Greek verb was originally an inflexible biliteral, triliteral, quadriliteral or dissyllabic radix. The variations were formed a long while after in the manner above intimated.

The Greeks had their substantive or auxiliary verb, from the Phœnician or Chaldean verb הוה, *fuit*. This verb, taking away the gentle aspirate from both beginning and end, actually becomes ει. This vocable the Greeks brought along with them from the East, and manufactured after their own manner, which appears to have been thus:

Pres.	εω, εις, ει,	εομεν, εετε, εοντι,
Cont.	ω, ις, ι,	ομεν, ιτε, οντι,
Fut.	εσω, εσεις, εσει,	εσομεν, &c.

We place οντι in the third person plural, because for many centuries ομικρον supplied the sound of the diphthong ου. By these variations it will appear that the radical verb was rendered capable of inflection. We have observed that Greek verbs were a collection of biliteral,

Exemplum Ionicarum Priscarum Literarum ex columna, quæ in via Appia reperta, postea ad hortos Farnesianos traducta est.

ODENI. ΘEMITON. METAKINESAI. EK. TO. TPIOPIO. HO
ESTIN. EPI. TO. TPITO. EN. TEI. HODOI. TEI. APPIAI. EN TOI
HEPODO. AAPOI. OAAP. LOION. TOI. KINESANTI. MAPTVS
DAIMON. ENHODIA. KAI. HOI. KIONES. DEMETPOS
KAI. KOPES. ANAΘEMA. KAI. ΘONION. ΘEON. KAI.

Sanskrit Alphabet.

Vowels.

अ	आ	इ	ई	उ	ऊ	ऋ	ॠ	ऌ	ॡ	ए	ऐ	ओ	औ	अं	अः
ă or ĕ	ā	ĕĕ	ēē	ŏŏ	ōō	rĭ	rī	lĭ	lrī	æ̆	ĕi	ō	au	un	ah, or eh

Connected Vowels.

क का कि की कु कू कृ कॄ कॢ कॣ के कै को कौ कं कः

Consonants.

क	ख	ग	घ	ङ	च	छ	ज	झ	ञ	ट	ठ	ड	ढ	ण	त	थ	द
kĕ	khĕ	gu	ghu	ṅ or ngĕ	chi	chha	ja	jha	niya	tà	thà	de	dhe	na	tĕ	t.hĕ	dĕ

ध	न	प	फ	ब	भ	म	य	र	ल	व	श	ष	स	ह	क्ष	ज्ञ
d.hĕ	ne	pa	p.ha	bĕ	bhe	mĕ	yĕ	ra	lĕ	wĕ	sà	sha	izh	kha	x	jnya or gya

W. Archibald sculp.

Greek Language.

literal, triliteral, or quadriliteral, radical words.—The following may serve for examples: τι, λεγ, Μαρ, τυπ, φαν, ταν, ρεπ, Δαμ, Δηλ, Δεικ.

These radicals are taken at random; and we believe our Grecian student, by adding the terminations, will readily find them all significant verbs. With these radicals, then, and the substantive verb, we suppose the present and future tenses were formed.

147 Original present that which is now the second future.

But it is now generally admitted that the modern present was not the original one of the verb. The second, or Attic future, appears plainly to have been the most ancient present. When the language was improved, or rather in the course of being improved, a new present was invented, derived indeed from the former, but differing widely from it in its appearance and complexion. Upon this occasion, the old present was degraded, and instead of intimating what was *doing at present*, was made to import what was immediately to be done hereafter. By this means, γραφεω, contracted into γραφῶ, *I am writing*, came to intimate, *I am just going to write*. This change was probably made for the sake of enriching the language, for variety, for energy. Thus, τυπεω contracted τυπῶ became τυπτω, τεκῶ, τικτω, &c. According to this theory, we find, that such verbs as now have no second future retain their original form, only the circumflex has been removed in order to accommodate them to the general standard. Grammarians have now chosen the three characteristic letters of active verbs from the present, first future, and perfect. The true characteristic of the original verb was that of the present second future. Many verbs are now destitute of that tense, because since the invention of the new present, those have fallen into disuse.

148 Formation of the modern present.

Let us now take the verb λεγω, *dico*, in order to make a trial; and let us write the radix and the auxiliary, first separately, and then in conjunction: Thus,

λεγ-εω, λεγ εις, λεγ-ει, λεγ-εομεν, λεγ-εετε, λεγ-εουσι. Then we will have contracted λεγῶ, λεγεῖς, λεγεῖ, λεγοῦμεν, λεγεῖτε, λεγουσι. Here, we believe, every thing is self-evident.

The English would run thus: Saying *I am*, saying *thou art*, saying *he is*, &c. At first the radix and the auxiliary were pronounced separately, as we do our helping verbs in English, and would have been written in the same manner had words been then distinguished in writing.

149 First future, and

The present first future occupied the same place that it now does, and concurred in its turn to complete the future in conjunction with the radix. That the substantive verb was inflected in the manner above laid down, is obvious from its future middle εσομαι, and from the future of the Latin verb *sum*, which was of old *eso*, *esis*, &c. Verbs in λω, μω, νω, ρω, often take σω in the first future. See *Fœd. Cret. ap. Marm. Oxon.* lib. 87. Verbs in λω and ρω assume σ by analogy, as κελλω, κελσω, *Eurip. Hecub.* v. 1057. κελσαι, *Hom. Od.* x. v. 511. τιλλω, τιλσω, *unde* τιλσον, *Il.* x. v. 707. ορω. ορσομεν, *Pind. Nem. Od.* 9. *Duodec.* 2. τειρω, τερσω, *Theoc. Idyll.* 22. v. 63. In fine, the Æolic dialect after the liquids often inserts σ.

It must be observed, that the Greeks, in order to accelerate the pronunciation, always throw out the ε and ο, except in verbs ending in αω, εω, οω; where they generally change them into η and ω. When the last letter of the radix can coalesce with σ after ε is thrown out, they transform it, so as to answer that purpose; if not, they sometimes throw it out. We shall once more take λεγω for an example:

λεγ-εσω, λεγ-εσεις, λεγ-εσει, &c.

Throwing out ε, it would stand λεγ-σω, λεγ-σεις, &c. by changing γς into ξ it becomes λεξω. Δ θ and σ cannot coalesce with σ, therefore they throw them out: thus, Αδω, future first ασω; πληθω, future first πλησω; Ανυτω, Ανυσω, &c.

These are the general rules with respect to the formation of the present and future of active verbs in the earliest stages of the Greek language. The limits prescribed will not allow us to pursue these conjectures; but the reader may, if he thinks proper, carry them a great way.

150 preterite tense.

The preterite tense falls next under consideration. If we may trust analogy, this, as well as the other two, must have owed its conformation to the radix of the verb, and some other word fitted to eke out its terminations. It has been thought by some critics, that this addition was taken from the Hebrew word חית; and we should be of the same opinion did not another auxiliary present itself nearer home, which appears to us much more congruous to such a purpose. Perhaps, indeed, the people from whom we suppose it borrowed, derived it from the eastern quarters. We have already observed, that the Thracians were masters of a great part of Greece in the very earliest ages. At that time they were a polite and learned people. From them a considerable part of the Greek language was derived. If, therefore, we should find a word in their language employed for the same purpose, and accommodated to coalesce with the radical verb, we feel ourselves very much inclined to prefer such a word.

151 Origin of the auxiliary verb.

The word *ha* pervades many different languages as an auxiliary verb. From it we have the Italian *ho*, the Spanish *he*, the French *ai*; and in one shape or other it appears in all the German and Scandinavian dialects. It is the Gothic auxiliary; and, we believe, it forms the termination of the perfect active of the first conjugation in the Latin tongue: For there *am* is the radix of *amo*; in the preterite *am-avi*, *amavi*: and the preterperfect *am-hav-eram*, i. e. *amaveram*, compounded of *am*, *hav*, and *eram*, the imperfect of the indicative of the substantive verb. This process, in the formation of the preterite of Latin verbs, will scarce be questioned, and forms certainly a presumptive proof that the Greeks pursued the same line. From this verb is likewise derived the Latin *habeo*, by changing *v* and *b*, which are indeed the same letter. Our readers, after this detail, will not be surprised if we should now hazard a conjecture, and declare it as our opinion, that this same Gothic auxiliary *ha* is actually the additional part of the preterite of Greek verbs, and that part upon which the conjugation depends.

In forming this combination between the radix and the auxiliary, the Greeks were obliged to fabricate several devices. As often as the last letter of the radix could not unite with the aspirate in *ha*, they metamorphosed it into one of the double letters, which are capable of coalescing with it. In the verb λεγω, γ was changed into χ; thus, λεγ *ha* became λεγχα, τυπτω preterite τυπ *ha*, was combined into τυφα. In verbs which had a radix that would not admit this conjunction, they hardened the *h* into κ, as in τιω, preterite τι-κα, Ακου-κα. Many other ways were contrived to facilitate this re-union. These are detailed in every Greek grammar, and so need not be mentioned.—What has been said with respect to this configuration, we offer as a pure conjecture, without the most remote intention of obtruding it upon our readers.

If it is admitted, that the auxiliary *ha* formed the conjugating termination of the active verb among the Greeks, it will likewise be admitted, that the radical verb and the other made originally two distinct words: that, according to this scheme, the preterite would proceed thus, λεγ *ha*, said *I have;* λεγ *has*, said *thou hast;* λεγ *he*, said *he hath*, &c. This process to us appears rational, elegant, and advantageous. The pluperfect was not then invented, and therefore it does not come under our consideration. The other tenses were all deduced from those described; and in forming these intermediate distinctive tenses, we believe that both critics and grammarians, and perhaps philosophers too, were employed. See GRAMMAR.

The eastern nations have diversified their verbs, by affixing fragments of the personal pronouns to the radix, by which they gained only the advantage of exhibiting the genders of the persons engaged in being, acting, and suffering; but a perpetual repetition of these was unavoidable. The Greeks, by their artificial combination of the radix with the two auxiliaries, avoided the necessity of repeating their personal pronouns, as we and the other modern inhabitants of Europe are obliged to do; and at the same time, by diversifying the terminations of their nouns and verbs, wonderfully improved the beauty and harmony of their language. The arrangement above insisted on is so very different from that of the orientals, and so entirely Gothic, that we think there can be no doubt that the Greeks borrowed this manœuvre from the Thracians. Every person moderately acquainted with the Greek language will, upon examination, discover a wonderful coincidence between the structure, idioms, and phraseology, of the English and Greek languages; so many congenial features must engender a strong suspicion that there once subsisted a pretty intimate relation between them.

In the preceding deduction, we find ourselves obliged once more to differ from the very learned author of the *Origin and Progress of Language*. As we took the liberty to question his originality of the Greek language, and at the same time presumed to attack the goodly structure raised by philosophers, critics, and grammarians; so we now totally differ from that learned writer as to his theory of the creation of verbs out of the inhabile matter of αω, εω, &c. This whole fabric, in our opinion, leans on a feeble foundation.

The apparatus of intermediate tenses, of augments, derivation of tenses, with their formation, participles, and idiomatical constructions, and other essentials or appendages, we omit, as not coming within the verge of the disquisition.

The derivation and formation of the middle and passive voices, would certainly afford matter of curious speculation; but the labour necessary to investigate this connection would greatly overbalance the benefit expected.

152
Derivation and formation of the middle voice.

However, to complete our plan, we shall subjoin a few strictures with respect to the formation of the middle voice, which was, in our opinion, immediately formed from the active.

We have seen already, that the active voice in its original state was formed by annexing fragments of the substantive or auxiliary verb to the radix. The same economy was observed in fabricating the flexible parts of the verb of the middle voice. To demonstrate this, we shall first conjugate the present tense of the auxiliary passive upon the principles above laid down.

Present, Εομαι, εεσαι, εεται, εομεθα, εεσθε, εονται. Such was the passive-present of the auxiliary. We shall now take our example from the verb τυπτω; second future τυπ-εομαι, *struck I am*, τυπ-εεσαι, *struck thou art*, τυπ-εεται, *struck he is*, &c. contracted τυπουμαι, τυπῃ, τυπειται. The conjunction and formation here is obvious. Perhaps, in the second person, σ was inserted, which, however, is thrown out in the process of the persons. The future middle is clearly formed, by affixing the future-passive of the verb εω, only as η was introduced into the language for ε long, it was generally (T) substituted instead of that vowel in verbs ending in αω and εω, and ω for ο in verbs ending in οω; the two vowels ε and ο being originally long as well as short, till η was adopted to denote the long sound of the former, and ω that of the latter. In many verbs, before the conjunction of the radix and auxiliary, ε was thrown out: thus, τυπ-εσομαι became τυψομαι, λεγ-εσομαι, λεξομαι, &c.

Plate CCCCXVI.

The preterite was deduced from that of the active by a very slight variation, so trifling, indeed, that it need not be mentioned; only we may observe, that the aspirate *h* is never retained in this tense, which originally seems to have been the only distinguishing character by which that tense of the middle voice differed from the same tense of the active.

From the strict analogy between the mode of forming the three primary tenses of the active and middle voice, we are led to suspect that what is now the middle was originally the passive voice.

The immediate formation of the former, by annexing the passive auxiliary, is obvious. The middle voice still partakes of the passive signification, since it has sometimes a passive, though more frequently an active. There are several parts of the present passive quite analogous to the same tenses in the middle: and, lastly, it is the common progress, in the course of improvement, to proceed step by step, and by approximation. What is most simple and easy is the first object, then succeeds what is only a little more difficult, and so on till we arrive at the last stage, when human ingenuity can go no farther. Now, it will readily be admitted, that the passive voice is much more embarrassed and intricate in its texture than the middle; and, therefore, the

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(T) We say generally, because in verbs ending in εω, the ε is sometimes retained, as τελεω, τελεσω, αρκεω-εσω.

the former should have been posterior in point of time to the latter.

We are well aware, that the very learned Kuster, and most other moderns, deeply skilled in the origin, progress, and structure, of the Greek language, have thought otherwise. The general opinion has been, that the Greek middle voice answered exactly to the Hebrew conjugation *hithpachal*, and in its pristine signification imported a reciprocality, or when the *agent acts upon itself*. For our part, we only intended a few hints upon the subject, which our learned readers may pursue, approve, or reject, at pleasure.

153 and of the passive.

If we might pretend to investigate the formation of the passive voice, we should imagine that the modern present was formed from the ancient one, by inserting such letters as were found necessary for beauty, variety, energy, &c.; the first future from the second future middle of the verb τιθημι, once θω. This future is θησομαι; and, joined to the radix, always occupies that place, τι-θησομαι, τελεθησομαι, φλεχθησομαι, τυφθησομαι, and so of the rest: whether μαι, σαι, ται, which occur so frequently as the terminations of the middle and passive voices, are fragments of some obsolete verb, we will not pretend to determine.

From verbs in αω, εω, οω, υω, are formed verbs in μι; which in the present, imperfect, and second aorist, as it is called, only have a different form, by assuming μι with a long vowel preceding it, in the present active; which vowel is preserved in each person singular. This collection of irregular verbs seems to be formed from the verb ειμι, which in some dialects might be ημι. Indeed the imperfect ην, ης, η, seems to imply as much: in this, however, we dare not be positive.

In the whole of this analysis of the formation of verbs, we have laid down what to us appears most plausible. That metaphysical critics may discover inaccuracies in the preceding detail we make no doubt; but our candid readers will doubtless reflect, that no language was ever fabricated by philosophers, and that the elements of language were hammered out by peasants, perhaps by savages. Critics have created a philosophy of language we admit, and have a thousand times discovered wonderful acuteness and ingenuity in the mechanism of words and sentences, where the original onomathetæ never apprehended any, and which possibly never existed but in their own heated imagination. If our more enlightened readers should find any thing in the preceding detail worthy their attention, so much the better; if the contrary should happen, we presume they will take up with the hackneyed system. We have all along neglected the dual number, because it regularly follows the type of the other numbers.

Be that as it may, before we drop this subject we must take the liberty to subjoin an observation or two with respect to the consequences of the practice of new modelling the present, and of course the imperfect, tenses of verbs. 1st, After this arrangement they commonly retained all the other tenses exactly as they had stood connected with the primitive verb: this needs no example. 2d, They often collected the tenses of verbs, whose present and imperfect were now obsolete, in order to supply this defect. Thus we have φερω-Οισω, ενεγκα, ηνοχα. 3d, They often formed present and imperfect tenses without any other tenses annexed: The poets in particular seem to have fabricated these two tenses at pleasure.

If this procedure was convenient for the poets, it was certainly most incommodious with respect to the vulgar, as well as to foreigners who had an inclination to learn the language. The vulgar, some ages after Homer and Hesiod, must have found it as difficult to understand their poems as our people do to comprehend those of Chaucer and Spenser. By this disposition, too, the etymology of verbs was almost entirely confounded. The present second future being, as has been observed, the ancient present, the attention of the curious etymologist was naturally diverted to the modern present, where it was utterly impossible to discover the radical word. A few examples will elucidate this point: τεινω, *to stretch*, *to extend*, old present ταινω; ταν is the radix, which at once appears to be a Persian word signifying *a large tract of country*. Hence *Mauritania* "the land of the Mauri," Aquitania, Bretania; and with *s* prefixed, Hindo-stan, Chusi-stan, Turque-stan. The obsolete verb οπω, whence οπτομαι, is evidently derived from *op*, an Egyptian name of the moon: φαινω, second future φανῶ, *to show*, from the Egyptian word *phan* or *pan*, a name of the sun: τυπτω, future second τυπῶ; τυπ is obviously the offspring of תף, *thaph*," a drum or timbrel," from beating or striking, &c. In such etymological researches, the student must be careful to turn the Ionic η into the Doric α; because the Dores were latest from the coast of Palestine, and consequently retained the largest share of the Phœnician dialect: thus γηθεω, *to rejoice*, turning η into α becomes γαθεω. This word, throwing away the termination, becomes *gath*, plainly signifying a *wine press* (U). It is likewise to be observed, that the Æolians often change α into υ, as συρξ instead of σαρξ, &c.

154 Greek infinitives used as nouns.

It is not our intention to enter into the arrangement and peculiar constructions of the Greek language. There is, however, one, which we cannot well pass over in silence. As that tongue is destitute of those words which the Latins call *gerunds*, to supply this defect they employ the infinitive with the article prefixed: thus, Εις το ειναι αυτȣς φιλȣς, *in order to their being friends*: απο τȣ ἑλεσθαι αυτους Βασιλεα, *from their having elected a king*; Εκ τȣ απο φευγειν αυτȣς εκ της πολεως, *from their flying out of the city*. In these phrases the infinitive is said to assume the nature of a substantive noun; agreeing with the article before it, exactly as if it were a noun of the neuter gender. Idioms of this kind occur in our own tongue; only with us the verb, instead of being expressed in the infinitive, is turned into the participle. According to this arrangement, the first of the preceding phrases, which, according to the Greek, would stand *toward to be friends*, in English is, *in order to their being friends*. This anomaly, then, if indeed it be such, is of no manner of consequence. The French, if we are not mistaken, would express it in the very same manner with the Greek, that is, *pour etre amis*.

From treating of verbs, we should naturally proceed to

(H) Hence it came to signify rejoicing, from the mirth and revelry attending the treading of the vine-press.

to the consideration of adverbs, which are so denominated, because they are generally the concomitants of verbs. Every thing relating to that part of speech, in the Greek tongue, may be seen in the Port Royal or any other Greek grammar. Instead therefore of dwelling upon this beaten topic, we shall hazard a conjecture upon a point to which the critics in the Greek tongue, as far as we know, have not hitherto adverted.

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Greek particles of oriental extraction.

The most elegant and most admired writers of Greece, and especially Homer, and after him Hesiod, abound with small particles, which appear to us pure expletives, created as it were to promote harmony, or fill up a blank without sense or signification. How those expletive particles should abound in that language beyond any other, we think, is a matter not easy to be accounted for. It has been said by the Zoili, that if you extract these nonentities from the poems of that bard, *qui solus meruit dici poeta*, a *magnum inane*, a mighty blank, would be left behind. We would willingly do justice to that pigmy race of words, and at the same time vindicate the prince of poets from that groundless imputation. Plato likewise, the prince of philosophers, has been often accused of too frequently employing these superfluous auxiliaries.

Those particles were no doubt imported from the east. It would be ridiculous to imagine that any description of men, however enthusiastically fond they might be of harmonious numbers, would sit down on purpose to fabricate that race of monosyllables purely to eke out their verses; mere sounds without significancy. In the first place, it may be observed, that there is a very strict connection among the particles of all cognate languages. To this we may add, that the not understanding the nature, relations, signification, and original import of those seemingly unimportant terms, has occasioned not only great uncertainty, but numberless errors in translating the ancient languages into the modern. The Greek language in particular loses a considerable part of its beauty, elegance, variety, and energy, when these adverbial particles with which it is replete are not thoroughly comprehended. An exact translation of these small words, in appearance insignificant, would throw new light not only on Homer and Hesiod, but even upon poets of a much posterior date. Particles, which are generally treated as mere expletives, would often be found energetically significant. It is however, altogether impossible to succeed in this attempt without a competent skill in the Hebrew, Chaldaic, Arabian, Persian, and old Gothic languages. We shall here take the liberty to mention a few of these particles which are most familiar, one or other of which occur in almost every line of Homer, and which we believe are either not understood or misunderstood. Such are Δα, δη, μεν, ητοι, μαν, γε, ρι, αρα, ρα, γεν. Δα is nothing else but the Chaldaic particle δα, the parent of the English *the*. It likewise signifies *by turns, in your turn;* δη is the same word in the Ionic dialect; μεν is a particle of the Hebrew affirmative אמן *amen, fides, veritas.* Μαν, a kind of oath by the moon, called *mana*, almost over all the east; hence Dor. μανα; γε, an oath by γεα, that is, *the earth;* αρα, another oath by the same element, probably from the oriental word of the same import; ρα is a fragment of αρα mentioned before; γεν, of γεα the *earth*, and εν or ων, an Egyptian name of the sun; ως, *as*, a particle which pervades all the dialects of the Gothic language. In this manner we believe all these small words that occur so frequently in the Greek tongue, and which have hitherto been held inexplicable, may be easily rendered in significant terms: and were this done, we believe they would add both beauty and energy to the clauses in which they stand. But this discussion must be left to more accomplished adepts.

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Prepositions.

We shall not explain the nature of prepositions, because we are convinced that few people will take the trouble to peruse this disquisition who are not already acquainted with their import in language. The Greek prepositions are eighteen in number, which need not be enumerated here. Most of these might be easily shown to be particles, or fragments deduced from oriental or Gothic words. The use of these words is to connect together terms in discourse, and to show the relation between them. In languages where, as in English, all these relations are expressed without any change on the termination of the nouns to which they are prefixed, the process is natural and easy. The whole is performed by juxtaposition. But in the Greek and Latin tongues, this effect is produced, partly by prefixing prepositions and partly varying the terminations of nouns. Had the Greeks been able to intimate all those relations by varying the terminations, or had they multiplied their prepositions to such a number as would have enabled them to express these relations without the casual variations, as the northern languages have done; in either case their language would have been less embarrassing than it is in its present state. According to the present arrangement both prepositions and the casual variations are used promiscuously to answer that purpose; a method which appears to us not altogether uniform. Though this plan might occasion little embarrassment to natives, it must, in our opinion, have proved somewhat perplexing to foreigners. The difficulty would be, as to the latter, when to adopt the one and when the other expedient.

Another inconveniency arises from the exceeding small number of prepositions in that language, which bear too small a proportion to the great variety of relations which they are appropriated to express. This deficiency obliged them often to employ the same preposition to denote different relations: For instance, Επι intimates, 1st, *upon;* as επι τȣ λιθȣ, *upon the stone;* and then it takes the genitive. 2d, It denotes *near upon;* as ἐπι τῳ λιθῳ, and then it governs the dative. 3d, The same preposition signifies *motion towards;* as Επεσεν ἐπι τον λιθον, *he fell upon the stone.* In these instances the same preposition intimates three different relations; and, which is still more embarassing, each of these requires a different case. The difficulty in this instance is so considerable, that even the most accurate of the Greek writers themselves often either forget or neglect the true application. Many examples of this might be adduced, did the limits assigned us admit such illustrations. Every man who has carefully perused the Grecian authors will readily furnish himself with examples.

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irregularly used,

Again, some prepositions, which indicate different relations, are prefixed to the same case. Thus, εξ signifies *from;* as, Εκ Διος αρχομεθα, *from Jupiter we begin;* ἀπ εμου βιου, *from my life*, or *my course of life;* προ των θυρων, *before the doors;* προ νικης εγκωμιον, *an encomium before the victory;* αντι αγαθων αποδιδοναι κακα, *to render evil*.

evil for good; αντι σου, against you. In these examples, and indeed every where, those prepositions intimate different relations, and yet are prefixed to the same cases. Sometimes the same preposition seems to assume two opposite significations: this appears from the preposition αντι just mentioned, which intimates both *for*, *instead of*, and *against* or *opposite to*.

What has been observed with respect to the prepositions above mentioned, the reader will readily enough apply to κατα, μετα, δια, περι. These incongruities certainly imply something irregular; and seem to intimate that those anomalies were so deeply incorporated with the constitution of the language, that the subsequent improvers found it impossible to correct them. Indeed to prefix a preposition to a case already distinguished by the affixed termination, appears to us a superfluity at least, if not an absurdity; for certainly it would have been more natural to have said εκ Ζευς αρχομεθα, than εκ Διος αρχομεθα. Some very learned men, who have inquired into *the origin of language*, have been of opinion that prepositions were the last invented species of words. If this opinion be well founded, we may suppose (and we think that this supposition is not altogether improbable) that the casual terminations of the Greek language were first affixed to the radix, in the manner above exhibited; and that prepositions were afterwards fabricated and prefixed to the cases already in use.

The syntax or construction of the Greek language does not, according to our plan, come within the compass of our present inquiry. This the curious Greek student will easily acquire, by applying to the grammars composed for that purpose. We have already hazarded a few conjectures with respect to the formation of the most important and most distinguished classes of words into which it has been divided by the most able grammarians, without, however, descending to the minutiæ of the language. As prepositions are the chief materials with which its other words, especially verbs, are compounded, we shall briefly consider the order in which they probably advanced in this process.

158 used in composition.

Complex ideas are compounded of a certain number or collection of simple ones. Of those complex notions, some contain a greater and some a smaller number of simple conceptions. In language, then, there are two ways of expressing those complex ideas, either by coining a word to express every simple idea separately, according to the order in which they stand in the mind; or by trying to combine two or more simple terms into one, and by that method to intimate one complex idea by one single word. The Arabians, notwithstanding all the boasted excellencies of their language, have never arrived at the art of compounding their words, in order to answer this noble purpose; and the sister dialects are but slenderly provided with this species of vocables. The Greeks, of all other nations (except perhaps those who spake the Sanscrit language), are unrivalled in the number, variety, propriety, elegance, energy, and expression of their compound terms, The Greeks, like the Arabians, in the earliest stages of their language, had only a collection of radical disjointed words, consisting of the jargons of the aboriginal Greeks, of the Pelasgi, Thracians, &c. How these words were arranged and constructed, we have no data remaining upon which we can found a critical investigation. We must therefore remain satisfied with such probable conjectures as the nature of the case, and the analogy of the language, seem to suggest.

The prepositions were originally placed before the nouns, whose relations they pointed out. For example, let us take the ξυναπεθνησκετο τοις ἀλλοις, *he died along with the rest*, or *he died out of hand along with the others.* These words were arranged thus: απεθνησκετο συν τοις αλλοις; and απο-θνησκον συν τοις αλλοις. In this manner the parts of every compound word were placed separately, at least as much as other words which had no connection.

159 The first compound words in Greek.

The first compound words of the Greek language were the radical nouns with the article, and the radical part of the substantive or auxiliary verb. The success of this experiment encouraged them to attempt the same in other words. By this noble invention they found themselves able to express, in one word, with ease and significancy, what in other languages, and formerly in their own, required a tedious ambages or circumlocution. In process of time, as their language was gradually mellowed, they increased the number of their compounds, till their language, in that respect, infinitely excelled all its parent dialects. In this process they were careful to unite such letters as not only prevented asperity and difficulty of pronunciation, but even promoted harmony and elegance. But this was the labour of posterior ages.

The Greeks were entirely ignorant of the derivation or etymology of their language: for this we need only consult Plato's Cratylus, Aristotle's Rhetoric, Demetrius Phalereus, Longinus, &c. In deducing patronymics, abstracts, possessives, gentiles, diminutives, verbals, &c. from radicals of every kind, they have shown the greatest art and dexterity. Examples of this occur almost in every page of every Greek author. But this extended no farther than their own language; every foreign language was an abomination to the Greeks. But more of this in the sequel.

160 Original materials of the Greek language;

The original materials of the Greek tongue were undoubtedly rough and discordant, as we have described them above. They had been collected from different quarters, were the produce of different countries, and had been imported at very distant periods. It would therefore be an entertaining, if not an instructing, speculation, if it were possible to discover by what men and by what means, this wonderful fabric was founded, erected, and carried to perfection. The writers of Greece afford us no light. Foreigners were unacquainted with that originally insignificant canton. Every thing beyond Homer is buried in eternal oblivion. Orpheus is indeed reported to have composed poems; but these were soon obliterated by the hand of time. The verses now ascribed to that philosophical hero are none of his*. Linus wrote, in the Pelasgic dialect, the achievements of the first Bacchus; Thamyris the Thracian wrote; and Pronapides the master of Homer was a celebrated poet. The works of all these bards did not long survive; and it is a certain fact that the Greek tongue was highly polished even more early than the age in which these worthies flourished. Homer, no doubt, imitated their productions, and some are of opinion that he borrowed liberally from them. The Greeks knew no more of the original character of their language, than of the original character and complexion of their progenitors. They allowed, indeed, that their language was originally barbarous and uncouth; but by what means or by what persons it was polished, enriched, and finally arranged, was to them an impenetrable secret.

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* *Pausan.* lib. i. cap. 22.

We have already demonstrated that the Ionim or aborigines of Greece were a race of barbarians; that consequently their language, or rather their jargon, was of the same contexture. The Pelasgi found both the people and their speech in this uncultivated state. These people arrived in Greece about the year before Christ 1760. It was then that the language of Greece began to be cultivated. Before the age of Homer the work seems to have been completed. Nothing of consequence was afterwards added to the original stock; on the contrary, not a few moieties were deducted from the Homeric treasure. The Pelasgi, as was said before, arrived in Greece *an. ant. Chr.* 1760. Homer is thought to have been born *an. ant. Chr.* 1041; consequently the cultivation of the Greek tongue was completed in a period of about 700 years. But upon the supposition that Orpheus, Linus, Thamyris, &c. wrote long before Homer, as they certainly did, that language had arrived nearly at the standard of perfection two centuries before; by which computation the period of its progress towards its stationary point is reduced to 500 years. But as the Pelasgi were a colony of foreigners, we ought to allow them one century at least to settle and incorporate with the natives, and to communicate their language, laws, manners, and habits, to the aborigines of the country. By this deduction we shall reduce the term of cultivation to less than four centuries.

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which was carried to its utmost perfection at a very early period.

During this period Greece was furiously agitated by tumults and insurrections. That country was divided into a number of independent states, which were perpetually engaged in quarrels and competitions. The profession of arms was absolutely necessary for the protection and preservation of the state; and the man of conduct and prowess was honoured as a demi-god, and his exploits transmitted with eclat to posterity. The Greek tongue was then rough and unpolished; because, like the ancient Romans, the bravest men were more disposed to act than to speak. Every language will take its colour from the temper and character of those who employ it; and had it not been owing to one class of men, the Greek tongue would have continued equally rough to the era of Homer as it had been a century after the arrival of the Pelasgi.

There has appeared among barbarous or half civilized people a description of men whose profession it has been to frequent the houses or palaces of the great, in order to celebrate their achievements, or those of their ancestors, in the sublimest strains of heroic poetry. Accordingly, we find that the Germans had their *bards*, the Gauls their *fads*, the Scandinavians their *scalds* or *scaldres*, the Irish their *fileas*, all retained for that very purpose. They lived with their chieftains or patrons; attended them to battle; were witnesses of their heroic deeds; animated them with martial strains; and celebrated their prowess, if they proved victorious; or, if they fell, raised the song of woe, and chanted the mournful dirge over their sepulchres. These bards were always both poets and musicians. Their persons were held sacred and inviolable. They attended public entertainments, and appeared in all national conventions. The chief of them were employed in the temples of the gods; and the less illustrious, like our minstrels of old, strolled about from place to place, and exercised their functions wherever they found employment.

Among the ancient Greeks there was a numerous tribe of men of the very same description who were at once poets and musicians, and whose office it was to celebrate the praises of the great, and to transmit their exploits to posterity in the most exaggerated encomiums. These poetical vagrants were styled Αοιδοι or songsters. Some of these lived in the houses of great men; while others, less skilful or less fortunate, strolled about the country in the manner above described. The more illustrious of these Αοιδοι who were retained in the temples of the gods, were certainly the first improvers of the language of the Greeks. Among the Hebrews we find the first poetical compositions were hymns in honour of Jehovah, and among the Pagans the same practice was established. In Greece, when all was confusion and devastation, the temples of the gods were held sacred and inviolable. There the Αοιδοι improved their talents, and formed religious anthems on those very models which their progenitors had chanted in the east.

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by the poets, who made a

The language of the Greeks was yet rugged and unmellowed: their first care was to render it more soft and more flexible. They enriched it with vocables suited to the offices of religion; and these, we imagine, were chiefly imported from the east. Homer every where mentions a distinction between the language of gods and men. The language of gods imports the oriental terms retained in the temples, and used in treating of the ceremonies of religion; the language of men intimates the ordinary civil dialect which sprung from the mixed dialects of the country. The priests no doubt concurred in promoting this noble and important purpose. From this source the strolling Αοιδοι drew the rudiments of their art; and from these last the vulgar deduced the elements of a polished style.

163
distinction between the language of gods and of men.

To these Αοιδοι of the superior order we would ascribe those changes mentioned in the preceding part of this inquiry, by which the Greek tongue acquired that variety and flexibility, from which two qualities it has derived a great share of that ease, beauty, and versatility, by which it now surpasses most other languages. The diversity of its terminations furnishes a most charming variety, while at the same time the sense is communicated to the reader or hearer by the relation between them. By this economy the poet and orator are left at liberty to arrange their vocables in that order which may be most soothing to the ear, and best adapted to make a lasting impression on the mind.

Few colonies have emigrated from any civilized country without a detachment of priests in their train. The supreme powers, whoever they were, have always been worshipped with music and dancing. The Hebrews, Phœnicians, and Egyptians, delighted in these musical and jocund festivals. The priests who attended the Iones, Dores, Æolians, Thebans, Athenians, &c. from the east, introduced into Greece that exquisite taste, those delicate musical feelings, which distinguish the Greeks from all the neighbouring nations. Hence that numerous race of onomatapœas, by which the Greek language is invested with the power of expressing almost every passion of the human soul, in such terms as oblige it to feel and actually to assimilate to the passion it would excite. Numberless instances of this occur in every page of Homer, Hesiod, Pindar, Sophocles, Euripides, and even of Aristophanes: to quote instances would be to insult the Greek student.

Every body knows that the practice of writing in verse was antecedent to the date of prosaic composition. Here, then, the Αοιδοι and the ministers of religion chiefly displayed their skill and discernment. By a judicious mixture of short and long syllables; by a junction of consonants which naturally slide into each other; by a careful attention to the rhythm, or harmony resulting from the combination of the syllables of the whole line—they completed the metrical tone of the verse, guided by that delicacy of musical feeling of which they were possessed before rules of prosody were known among men.

Much liberty was certainly used in transposing letters, in varying terminations, in annexing prefixes and affixes, both to nouns and other kinds of words where such adjuncts were possible: and upon this occasion we think it probable, that those particles of which we have spoken above were inserted like filling stones thrust in to stop the gaps or chinks of a building. Verses were then clumsy and irregular, as the quantity of vowels was not duly ascertained, and the collision of heterogeneous consonants not always avoided. Probably these primitive verses differed as widely from the finished strains of Homer and his successors, as those of Chaucer and Spencer do from the smooth polished lines of Dryden and Pope.

164 **Earliest poets of Greece.** The poetical compositions of the earliest Greeks were not, we think, in the hexameter style. As they were chiefly calculated for religious services, we imagine they resembled the Hebrew iambics preserved in the song of Aaron and Miriam, Deborah and Barak, Psalms, Proverbs, &c. which were indeed calculated for the same purpose. Archilochus perhaps imitated these, though the model upon which he formed his iambics was not generally known. The later dramatic poets seem to have copied from the same archetypes. Hexameters, it is probable, were invented by Orpheus, Linus, Thamyris, Musæus, &c. The first of these travelled into Egypt, where he might learn the hexameter measure from that people, who used to bewail *Maneros* and *Osiris* in elegiac strains. This species of metre was first consecrated to theology, and the most profound sciences of moral and natural philosophy; at length it was brought down to celebrate the exploits of kings and heroes.

> *Res gestas regumque, ducumque, et fortia bella,*
> *Quo scribi possent numero monstravit* Homerus.

We have hazarded a conjecture above, importing that the earliest poetical compositions of the Greeks were consecrated to the service of the gods. We shall now produce a few facts, which will furnish at least a presumptive evidence of the probability of that conjecture.

165 **Orpheus.** Orpheus begins his poem with ancient chaos, its transformations and changes, and pursues it through its various revolutions. He then goes on to describe the offspring of Saturn, that is time, the æther, love, and light. In short, his whole poem is said to have been an oriental allegory, calculated to inspire mankind with the fear of the gods, and to deter them from murder, rapine, unnatural lusts, &c.

166 **Musæus.** Musæus was the favourite scholar of Orpheus, or perhaps his son. He composed prophecies and hymns, and wrote sacred instructions, which he addressed to his son. He prescribed atonements and lustrations; but his great work was a Theogony, or History of the Creation, &c.

167 **Melampus.** Melampus brought the mysteries of Proserpine from Egypt into Greece. He wrote the whole history of the disasters of the gods. This seer is mentioned by Homer himself.

168 **Olen.** Olen came from Lycia, and composed the first hymn that was sung in Delos at their solemnities; he probably emigrated from Patara a city of Lycia, where Apollo had a celebrated temple and oracle.

The Hyperborean damsels used to visit Delos, where they chaunted sacred hymns in honour of the Delian god.

169 **Homer and Hesiod.** To these we add the great Homer himself, if indeed the hymns commonly annexed to the Odyssey are his composition. Hesiod's Theogony is too well known to need to be mentioned.

From these instances we hope it appears, that the origin of the poetry of Greece is to be found in the temples; and that there, its measure, numbers, rhythm, and other appendages, were originally fabricated.

170 **Different dialects, with their origin.** The Grecian poets, however, enjoyed another advantage which that class of writers have seldom possessed, which arose from the different dialects into which their language was divided. All those dialects were adopted indifferently by the prince of poets; a circumstance which enabled him to take advantage of any word from any dialect, provided it suited his purpose. This, at the same time that it rendered versification easy, diffused an agreeable variety over his composition. He even accommodated words from Macedonia, Epirus, and Illyricum, to the purposes of his versification: Besides, the laws of quantity were not then clearly ascertained; a circumstance which afforded him another conveniency. Succeeding poets did not enjoy these advantages, and consequently have been more circumscribed both in their diction and numbers.

The Greek language, as is generally known, was divided into many different dialects. Every sept, or petty canton, had some peculiar forms of speech which distinguished it from the others. There were, however, four different dialectical variations which carried it over all the others. These were the Attic, Ionic, Æolic, and Doric. These four dialectical distinctions originated from the different countries in the east from which the tribes respectively emigrated. The Attics consisted, 1st, of the barbarous aborigines; 2d, of an adventitious colony of Egyptian Saïtes; 3d, a branch of Ionians from the coast of Palestine. These last formed the old Ionian dialect, from which sprung the Attic and modern Ionic. The Æolians emigrated from a different quarter of the same coast; the inhabitants of which were a remnant of the old Canaanites, and consequently different in dialect from the two first-mentioned colonies. The Dores sprang from an unpolished race of purple fishers on the same coast, and consequently spoke a dialect more coarse and rustic than any of the rest. These four nations emigrated from different regions; a circumstance which, in our opinion, laid the foundation of the different dialects by which they were afterwards distinguished.

It is impossible in this short sketch to exhibit an exact view of the distinguishing features of each dialect. Such an analysis would carry us far beyond the limits of the article in question. For entire satisfaction on this head, we must refer the Grecian student to Mattaire's *Græcæ Linguæ Dialecti*, where he will find every thing necessary to qualify him for understanding that subject. We shall content ourselves with the few observations following.

The Athenians being an active, brisk, volatile race, delighted in contractions. Their style was most exquisitely polished. The most celebrated authors who wrote in that dialect were the following: Plato, Thucydides, Xenophon, Demosthenes, and the other orators; Æschylus, Euripides, Sophocles, Aristophanes, Menander, Diphilus, with the other comic and tragic poets. That dialect was either ancient or modern. The ancient Attic was the same with the Ionic.

The Ionic, as was said, was the ancient Attic; but when that nation emigrated from Attica and settled on the coast of Asia Minor, they mingled with the Carians and Pelasgi, and of course adopted a number of their vocables. They were an indolent, luxurious, and dissolute people; of course their style was indeed easy and flowing, but verbose, redundant, and without nerves. This, however, is the leading style in Homer; and after him a prodigious number of writers on every subject have used the same dialect, such as Herodotus of Halicarnassus the celebrated historian; Ctesias of Cnidus the historian of Persia and India; Hecatæus of Miletus; Megasthenes the historian, who live under Seleucus Nicator; Hippocrates the celebrated physician of Coos; Hellanicus the historian often mentioned with honour by Polybius; Anacreon of Teia, Alcæus, Sappho of Lesbos, excellent poets; Pherecydes Syrus the philosopher, and a multitude of other persons of the same profession, whom it would be superfluous to mention upon the present occasion.

The Æolic and Doric were originally cognate dialects. When the Dorians invaded Peloponneus, and settled in that peninsula, they incorporated with the Æolians, and their two dialects blended into one produced the new Doric. The original Dores inhabited a rugged mountainous region about Ossa and Pindus, and spoke a rough unpolished language similar to the soil which they inhabited. Andreas Schottus, in his observations on poetry, lib. ii. cap. 50. proves from an old manuscript of "Theocritus, that there were two dialects of the Doric tongue, the one ancient and the other modern; that this poet employed Ionic and the modern Doric; that the old Doric dialect was rough and cumbrous; but that Theocritus has adopted the new as being more soft and mellow." A prodigious number of poets and philosophers wrote in this dialect, such as Epicharmus the poet; Ibycus the poet of Rhegium; Corinna the poetess of Thespis, or Thebes, or Corinth, who bore away the prize of poetry from Pindar; Erynna a poetess of Lesbos; Moschus the poet of Syracuse; Sappho the poetess of Mitylene; Pindarus of Thebes, the prince of lyric poets; Archimedes of Syracuse, the renowned mathematician; and almost all the Pythagorean philosophers. Few historians wrote in that dialect; or if they did, their works have not fallen into our hands. Most of the hymns sung in temples of the gods were composed in Doric; a circumstance which evinces the antiquity of that dialect, and which, at the same time, proves its affinity to the oriental standard.

After that the Greek tongue was thoroughly polished by the steps which we have endeavoured to trace in the preceding pages, conscious of the superior excellency of their own language, the Greeks, in the pride of their heart, stigmatized every nation which did not employ their language with the contemptuous title of *barbarians*. Such was the delicacy of their pampered ears, that they could not endure the untutored voice of the people whom the called Βαρβαροφωνοι. This extreme delicacy produced three very pernicious effects; for, 1st, It induced them to metamorphose and sometimes even to mangle, foreign names, in order to reduce their sound to the Grecian standard; and, 2d, It prevented their learning the languages of the east, the knowledge of which would have opened to them an avenue to the records, annals, antiquities, laws, customs, &c. of the people of those countries, in comparison of whom the Greeks themselves were of yesterday, and knew nothing. By this unlucky bias, not only they, but even we who derive all the little knowledge of antiquity we possess through the channel of their writings, have suffered an irreparable injury. By their transformation of oriental names they have in a manner stopped the channel of communication between the histories of Europe and Asia. This appears evident from the fragments of Ctesias's Persian history, from Herodotus, Xenophon, and all the other Grecian writers who have occasion to mention the intercourse between the Greeks and Persians. 3d, It deprived them of all knowledge of the etymology of their own language, without which it was impossible for them to understand its words, phraseology, and idioms, to the bottom. We mentioned Plato's Cratylus above. In that dialogue, the divine philosopher endeavours to investigate the etymology of only a few Greek words. His deductions are absolutely childish, and little superior to the random conjectures of a school-boy. Varro, the most learned of all the Romans, has not been more successful. Both stumbled on the very threshold of that useful science; and a scholar of very moderate proficiency in our days knows more of the origin of these two noble languages, than the greatest adepts among the natives did in theirs. By prefixes, affixes, transpositions of letters, new conjunctions of vowels and consonants for the sake of the music and rhythm, they have so disguised their words, that it is almost impossible to develope their original. As a proof of this, we remember to have seen a manuscript in the hands of a private person where the first twelve verses of the Iliad are carefully analysed; and it appears to our satisfaction, that almost every word may be, and actually is traced back to a Hebrew, Phœnician, Chaldean, or Ægyptian original: And we are convinced that the same process will hold good in the like number of verses taken from any of the most celebrated poets of Greece. This investigation we found was chiefly conducted by reducing the words to their original invariable state, which was done by stripping them of prefixes, affixes, &c. These strictures are, we think, well founded; and consequently need no apology to protect them.

171 The partiality of the Greeks to their own tongue, and its evil consequences.

172 Beauty of the Greek language.

These imperfections, however, are counterbalanced by numberless excellencies: and we are certainly much more indebted to that incomparable people for the information they have transmitted to us through the medium of their writings, than injured by them in not conveying to us and to themselves more authentic and more ample communications of ancient events and occurrences. Without fatiguing our readers with superfluous encomiums on a language which has long ago been extolled perhaps to an extravagant degree by the labours of men of the most enlarged capacity and the most refined taste, we shall now proceed to make a few observations on *spirits* and *accents;* which being rather appendages than essentials of the language, we have on purpose reserved for the last place.

173 The spiritus asper and lenis.

Every word in the Greek language beginning with a vowel is marked with a spirit of breathing: This aspiration is double, namely *lenis et asper*, "the gentle, and rough or aspirated." The gentle accent, though always marked, is not now pronounced, though in the earliest periods of the language it was undoubtedly enounced, though very softly. Both these aspirations were imported from the east. They were actually the Hebrew ה *he* and ח *heth*. The former denoted the *spiritus lenis*, and and latter the *spiritus asper*. The Hebrew prefixed *ha* or *he* to words beginning with a vowel, and of course the Greeks followed their example. These people seem to have delighted in aspirates; and of consequence the letter ς is, some think, rather too often affixed to the terminations of their words. Every word beginning with ρ had the aspirate joined to ρ, probably with a design to render the aspiration still more rough.

174 The accents.

The Greek accents are three in number; the acute, the grave, and the circumflex. The acute raises and sharpens the voice; the grave depresses and flattens it; the circumflex first raises and sharpens the voice, and then depresses and flattens it. It is obviously composed of the other two. The learned author of the *Origin and Progress of Language* has taken much pains to prove that these accents were actually musical notes, invented and accommodated to raise, depress, and suspend the voice, according to a scale of musical proportions. It is scarce possible, we think, for a modern Greek scholar to comprehend distinctly the ancient theory of accents. These the native Greeks learned from their infancy, and that with such accuracy, that even the vulgar among the Athenians would have hissed an actor or actress off the stage or an orator off the pulpitum *, on account of a few mistakes in the enunciation of those notes.

The elevations, depressions, and suspensions of the voice upon certain syllables, must have made their language sound in the ears of foreigners somewhat like recitative, or something nearly resembling *cant*. But the little variety of these syllabic tones, and the voice not resting upon them, but running them on without interruption, sufficiently distinguished them from music or cant. Be that as it may, we think it highly probable, that the wonderful effects produced by the harangues of the orators of Greece on the enraptured minds of their hearers, were owing in a good measure to those artificial musical tones by which their syllables were so happily diversified.

To this purpose we shall take the liberty to transcribe a passage from Dion. Halic. *De Structura Orationis*, which we find translated by the author of the *Origin and Progress of Language*, vol. ii. book 3d, part ii. chap. 7. page 381. "Rhetorical composition is a kind of music, differing only from song or instrumental music, in the degree, not in the kind; for in this composition the words have melody, rythm, variety, or change, and what is proper or becoming: So that the ear in it, as well as in music, is delighted with the melod[illegible] moved by the rythm, is fond of variety, and desires with all these what is proper and suitable. The difference, therefore, is only of greater and less."

With respect to accents, it may be observed that only one syllable of a word is capable of receiving the acute accent, however many there be in the word. It was thought that the raising the tone upon more than one syllable of the word, would have made the pronunciation too various and complicated, and too like chanting.

The *grave accent* always takes place when the acute is wanting. It accords with the level of the discourse; whereas the acute raises the voice above it.

The *circumflex accent* being composed of the other two is always placed over a long syllable, because it is impossible first to elevate the voice and then to depress it on a short one. Indeed among the Greeks a long syllable was pronounced like two short ones; and we apprehend it was sometimes written so, especially in later times. It is altogether obvious from two learned Greek authors, Dion. Halic. and Aristoxenus, that the Greek accents were actually musical notes, and that these tones did not consist of loud and low, or simply elevating and depressing the voice; but that they were uttered in such a manner as to produce a melodious rythm in discourse.

In a word, the acute accent might be placed upon any syllable before the antepenult, and rose to a *fifth* in the diatonical scale of music; the grave fell to the third below it. The circumflex was regulated according to the measure of both, the acute always preceding. The grave accent is never marked except over the last syllable. When no accent is marked, there the grave always takes place. Some words are called *enclitics*. These have no accent expressed, but throw it back upon the preceding word. The circumflex, when the last syllable is short, is often found over the penult, but never over any other syllable but the last or the last but one.

175 The ancient Greeks had no accentual marks.

The ancient Greeks had no accentual marks. They learned those modifications of voice by practice from their infancy; and we are assured by good authority, that in pronunciation they observe them to this day. The accentual marks are said to have been invented by a famous grammarian, Aristophanes of Byzantium, keeper of the Alexandrian library under Ptolemy Philopater, and Epiphanes, who was the first likewise who is supposed to have invented punctuation. Accentual marks, however, were not in common use till about the seventh century; at which time they are found in manuscripts. If our curious readers would wish to enter more deeply into the theory of accents, we must remit them to Origin of Language, vol. ii. lib. 2. *passim;* and to Mr Foster's Essay on the different Nature of Accent and Quantity.

Such, in general, are the observations which we thought the nature of our design obliged us to make on the origin and progress of the Greek language. Some of our more learned readers may perhaps blame us for not interspersing the whole disquisition with quotations from the most celebrated writers in the language which has been the object of our researches. We are well aware that this is the general practice in such cases. The books were before us, and we might have transcribed from them more quotations than the nature of an article of this kind would permit. In the first part there were no books in that language to quote from, because the Greeks knew nothing of their own origin, nor of that of their language, and consequently have recorded nothing but dreams and fictions relating to that subject. Even when we had made considerable progress in our inquiry, the nature of the plan we have adopted excluded in a great measure the use of quotations. When we drew near the conclusion, we imagined that our learned readers would naturally have recourse to the passages alluded to without our information, and that the unlearned would not trouble themselves about the matter. The Greek student who intends to penetrate into the depths of this excellent language, will endeavour to be thoroughly acquainted with the books after mentioned.

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* See Pulpitum.

176 Books to be studied by every one who wishes to be a master of this language.

Aristotle's Rhetoric and Poetics, his book *De Interpretatione*, especially with Ammonius's Commentary. Ammonius was a native of Alexandria, and by far the most acute of all the ancient grammarians.

Dion. Halic. *De Structura Orationis*, where, amidst abundance of curious and interesting observations, will be found the true pronunciation of the Greek letters.

Demetrius Phalereus *De Elocutione;* a short essay indeed, but replete with instruction concerning the proper arrangement of words and members in sentences.

Longinus, the prince of critics, whose remains are above commendation. Theodorus Gaza ‡ and the other refugees from Constantinople, who found an hospitable reception from the munificent family of the Medici, and whose learned labours in their native language once more revived learning and good taste in Europe. These, with some other critics of less celebrity, but equal utility, will unlock all the treasures of Grecian erudition, without however disclosing the source from which they flowed. To these one might add a few celebrated moderns, such as Mons. Fourmont the Elder, Mons. Gebelin, Abbé Pezron, Salmasius, and especially the learned and industrious Lord Monboddo.

‡ See *Gaza*.

We shall now give a very brief account of the vast extent of the Greek language even before the Macedonian empire was erected; at which period, indeed, it became in a manner universal, much more than ever the Latin language could accomplish notwithstanding the vast extent of the Roman empire.

177 Vast extent of the Greek language.

Greece, originally Hellas, was a region of small extent, and yet sent out many numerous colonies into different parts of the world. These colonies carried their native language along with them, and industriously diffused it wherever they formed a settlement. The Iones, Æoles, and Dores, possessed themselves of all the west, and north-west coast of the Lesser Asia and the adjacent islands; and there even the barbarians learned that polished language. The Greek colonies extended themselves along the south coast of the Euxine sea as far as Sinope, now Trebizund, and all the way from the west coast of Asia Minor: though many cities of barbarians lay between, the Greek tongue was understood and generally spoken by people of rank and fashion.

There were Greek cities on the north coast of the Euxine sea to the very eastern point, and perhaps beyond even those limits; likewise in the Taurica Chersonesus, or Crim Tartary; and even to the mouth of the Danube, the straits of Caffa, &c. In the neighbourhood of all these colonies, the Greek language was carefully propagated among the barbarians, who carried on commerce with the Greeks.

A great part of the south of Italy was planted with Greek cities on both coasts; so that the country was denominated *Magna Græcia*. Here the Greek tongue universally prevailed. In Sicily it was in a manner vernacular. The Ionians had sent a colony into Egypt in the reign of Psammitichus; and a Greek settlement had been formed in Cyrenia many ages before. The Phocians had built Massilia or Marseilles as early as the reign of Cyrus the Great, where some remains of the Greek language are still to be discovered. Cæsar tells us, that in the camp of the Helvetii registers were found in Greek letters. Perhaps no language ever had so extensive a spread, where it was not propagated by the law of conquest.

178 Greek spoken at present.

The Greek tongue, at this day, is confined within very narrow limits. It is spoken in Greece itself, except in Epirus, and the western parts of Macedonia. It is likewise spoken in the Grecian and Asiatic islands, in Candia or Crete, in some parts of the coast of Asia Minor, and in Cyprus: but in all these regions, it is much corrupted and degenerated.

As a specimen, we shall insert a modern Greek song, and the advertisement of a quack medicine, which with other plunder, was brought by the Russians from Chocsim or Chotzim in 1772.

Song in modern Greek.

ΜΙ δυστιχίαις πολεμῶ μί βάσανα ὡς τὸ λεμό
  Εἶμαι, και κιντινύω, καὶ νὰ χαθω κοντεύω
Στὸ πέλαγος των συμφορῶν με ἐπικινδυνοι καιρὸν
  Μ᾽ ἀνέμȣς ὀλάθριȣς σφοδρȣς και ἐναντιȣς.
Μι κύματα πολλῶν καὶ μᾶν τυφανὶ ανεστιασμῶν.
  Θαλασσα φȣσκομένη, πόλλα ἀγριομένη,
Ὅπȣ̃ ἀφριζι καί φησὰ γι σαγανάκια πιρισσά
  Σύνεφα σκοτισμένα καὶ κατασυγχισμένα,
Και νὰ φανῆ μιὰ σωτηρία, νὰ ιδȣ̃ν τά μάτιά μυστιριὰ.
  Γλίχα νερα νὰ εὕρω, κάσχα καί δεν ἠξεύρω,
Ν᾽ ἀραξω και δεν ἠμπορῶ γιατι λιμένα δεν θωρῶ.
  Μ᾽ ἀπελπισίαν θρέχω ὅτα ἅρμενα πȣ̃ ἔχω.
Πȣ̃ μὲ αὐτὰ κὰν νὰ πνυγῶ ἢ σελαμέτινα εὐγῶ,
  Καὶ τȣτα ἂν βασταξȣν, ἐμπορȣ̃ν νὰ μὲ φυλαξȣν.

Translation.

With dire misfortunes, pains, and woes,
O'erwhelm'd, ingulph'd, I struggling fight;
  O'er my frail bark proud billows close,
To plunge her deep in lasting night.
  Rough seas of ills incessant roar,
Fierce winds adverse, with howling blast,
  Heave surge on surge. Ah! far from shore
My found'ring skiff shall sink at last.
  Involv'd in low'ring darksome clouds,
'Mid sultry fogs, I pant for breath;
  Huge foaming billows rend my shrouds,
While yawning gulfs extend beneath.
  From bursting clouds loud thunders roll,
And deaf'ning peals terrific spread;
  Red lightnings dart from pole to pole,
And burst o'er my devoted head.
  When shall the friendly dawning rays
Guide me to pleasures once possest;
  And breezy gales, o'er peaceful seas,
Waft to some port of endless rest?

In dark despair, with tempests tost,
I veer my sail from side to side.
Conduct me, Heav'n! to yond' fair coast,
Or plunge me in the 'whelming tide.

The Quack Bill.

ΒΑΛΣΑΜΟΝ ΤΗΣ ῾ΙΕΡΟΥΣΑΛΗΜ, ΑΠΟ ΤΑΙΣ, ΚΑΙ ΝΟΥΡΙΑΙΣ, ΚΑΙ ΠΑΛΕΑΙΣ ΡΕΤΖΕΤΑΙΣ.

ΤΟΥΤΟ τὸ μπαλσαμον ὠφελεῖ εις τὸ ἀδυνατόν σομαχι, καὶ βοηθεῖ τὴν χονευσιν δυναμώνει τὴν καρδίαν. συκώνει ὅλας τὰς ἐμφράξεις τῆς κοιλιας ωφελεῖ εἰς τὴν σινασιν καὶ βῆχα παλαιὸν. ῾Ιατρέυει τὰς ἐσωτερικὰς πληγὰς τȣ̃ σήθȣς, καὶ τȣ̃ πνεύμονος ἤγουν πλεμονίȣ. κινεῖ τα καταμήνια τῶν γυναικῶν. Ἐις τὰς ἐξωτερικὰς πληγὰς πρέπει νὰ βάζεται μὲ τὸ ξανθὸ τόσον ὲις παλαιὰς. Οσον καὶ ἐυσπας, καθὼς εἶναι ἡ σπαθιαῖς, καὶ μαχαιριαῖς, καὶ ἀλλα κοψίματα ἰατρευει κάθελογῆς Φισολα, καὶ ὅλας τὰς βρομερὰς πληγὰς ὁπȣ̃ ἔφθασαν ὲις τὸ κὄκαλον θαυμάσιως, ὠφελεῖ εἰς τὰ ἀυτία ὁπȣ̃ τρέχουν ἔμπυον νά σαζεται δὺο ἢ τρεῖς κόμπȣς ἤχουν σαλαγματίας μεδαμπάκι βρεμμένον εἰς ἀυτὸ, βάνεται εἰς τὰς πληγωμενας δοντοκοιλιαῖς καὶ θέλουν ῾ατρευθῆ. καὶ ἀκόμι δυναμώνει τὰ ὀδόντια ὁπȣ̃ κινοῦνται δε θελουν νὰ πέσουν. βοηθᾶ καὶ ἀπὸ τὴν πανὺκλαν.

῾Η δόσις ἐσωτερικῶς ἂς εἶναι δέκα ἢ καὶ δώδεκα κόμπȣς εἰς ὀλίγον κρασὶ, ἢ καὶ νερον, τὸ κάθε ταχυ καὶ βράδυ. ἂς τὸ μεταχειρίζεται, καὶ εἶναι θαυμάσιον μὲτὴν δοκιμὴν βεβαιωμενον.

Ἀληθὲς βάλσαμον τȣ̃ Βασιλεως.

Instead of giving a literal and bald translation of this advertisement, which runs exactly in the style of other quack bills, it may be sufficient to observe, that the medicine recommended is said, when taken inwardly, to raise the spirits, remove costiveness and inveterate coughs; to cure pains of the breast and bellyaches; to assist respiration, and remove certain female obstructions. When applied externally, it cures wounds and sores, whether old or fresh, removes ringing of the ears, fastens the teeth when loose, and strengthens the gums.

All this, and much more, it is said to do in a wonderful manner; and is declared to be the true royal balsam of Jerusalem, and an universal specific.

It is indeed next to a miracle that so many monuments of Grecian literature are still to be found among men. Notwithstanding the burning of the famous library of Alexandria, and the almost numberless wars, massacres, and devastations, which have from time to time in a manner desolated those countries where the Greek language once flourished; we are told that there still remain about 3000 books written in that language.

179
Distinguished stages of the Greek language.

We shall now conclude this section with a brief detail of the most distinguished stages and variations through which this noble tongue made its progress from the age of Homer to the taking of Constantinople, *anno Chr.* 1453; a period of more than 2000 years.

Homer gave the Greek poetry its colour and consistency, and enriched, as well as harmonized, the language. It seems, from the coincidence of epithets and cadence in Homer and Hesiod, that the Greek heroic verse was formed spontaneously, by the old Αοιδοι, a sort of *improvisatori;* and that Homer and his first followers adopted their versification. The Iliad and Odyssey have much of the air of extempore compositions; an epithet is never wanting to fill up a verse; and a set of expressions are mechanically annexed to such ideas as were of frequent recurrence. Hence that copiousness and waste of words in the old Greek bard, which forms such a contrast to the condensed and laboured composition of Virgil.

The Greek prose was of a more difficult structure; and it may be distributed into different styles or degrees of purity. Of the prose authors now extant, the first and best style is that of Herodotus, and of Plato in the florid or mixed kind, of Xenophon in the pure and simple, of Thucydides and Demosthenes in the austere. Nothing, perhaps, is so conducive to form a good taste in composition as the study of these writers.

The style of Polybius forms a new epoch in the history of the Greek language: it was the idiotic or popular manner of expression, especially among military men, in his time, about the 150th Olympiad. It became the model of succeeding writers, by introducing a simple unstudied expression, and by emancipating them from the anxious labour of the Old Greeks respecting the cadence and choice of words. The style of the New Testament, being plain and popular, frequently resembles that of Polybius, as has been shown by Raphelius, and by Kirchmaier, *de parallelismo* N. T. *et Polybii*, 1725.

Before this historian, the Alexandrian Jews had formed a new or Hellenistic style, resulting from the expression of oriental ideas and idioms in Greek words, after that language had lost of its purity, as it gained in general use, by the conquests of Alexander. The Hellenistic is the language of the Septuagint, the Apocrypha, the New Testament, and partly of Philo and Josephus. This mixture in the style of the evangelists and apostles, is one credential of the authenticity of the best of all books, a book which could not have been written but by Jewish authors in the first century. See the fine remarks of Bishop Warburton, Doctrine of Grace, book i. ch. 8—10. Critics lose their labour in attempting to adjust the Scripture-Greek to the standard of Atticism.

The diction of the Greek historians, and geographers of the Augustan age, is formed on that of Polybius; but improved and modernized, like the English of the present age, if compared with that of Clarendon or Bacon. More perspicuous than refined, it was well suited to such compilations as were then written by men of letters, such as Dionysius, Diodorus, and Strabo, without much experience or rank in public life.

The ecclesiastical style was cultivated in the Christian schools of Alexandria, Antioch, and Constantinople; rank and luxuriant, full of oriental idioms, and formed in a great measure on the Septuagint version. Such is, for instance, the style of Eusebius. After him, the best Christian writers polished their compositions in the schools of rhetoric under the later sophists. Hence the popular and flowing purity of St Chrysostome, who has more good sense than Plato, and perhaps as many good words.

On the Greek of the Byzantine empire, there is a good dissertation by Ducange, *de causis corruptæ Græcitatis*, prefixed to his Glossary, together with Portius's Grammar of the modern Greek. This last stage of the Greek language is a miserable picture of Turkish barbarism.

barism. And, which is most surprising, there is no city of Greece where the language is more different from the ancient than at Athens. The reason of that is, because it has been long inhabited by a mixed multitude of different nations.

To conclude, the Greeks have left the most durable monuments of human wisdom, fortitude, magnificence, and ingenuity, in their improvement of every art and science, and in the finest writings upon every subject necessary, profitable, elegant, or entertaining.

The Greeks have furnished the brightest examples of every virtue and accomplishment, natural or acquired, political, moral, or military: they excelled in mathematics and philosophy; in all the forms of government, in architecture, navigation, commerce, war: as orators, poets, and historians, they stand as yet unrivalled, and are like to stand so for ever; nor are they less to be admired for the exercises and amusements they invented, and brought to perfection, in the institution of their public games, their theatres, and sports.

180
No perfect translation of any Greek author.

Let us further observe, that in vain our readers will look for these admired excellencies in any of the best translations from the Greek: they may indeed communicate some knowledge of what the originals contain; they may present you with propositions, characters, and events: but allowing them to be more faithful and more accurate than they really are, or can well be, still they are no better than copies, in which the spirit and lustre of the originals are almost totally lost. The mind may be instructed, but will not be enchanted: The picture may bear some faint resemblance, and if painted by a masterly hand give pleasure; but who would be satisfied with the canvass, when he may possess the real object? who would prefer a piece of coloured glass to a diamond? It is not possible to preserve the beauties of the original in a translation.—The powers of the Greek are vastly beyond those of any other tongue. Whatever the Greeks describe is always felt, and almost seen; motion and music are in every tone, and enthusiasm and inchantment possess the mind:

> *Graiis ingenium, Graiis dedit ore rotundo,*
> *Musa loqui.* HORACE.

181.
Origin of the Romans, and of their language.

SECT. VIII. *Of the Latin Language.*

THIS language, like every other spoken by barbarians, was in its beginning rough and uncultivated.—What people the Romans were, is a point in which antiquarians are not yet agreed. In their own opinion they were sprung from the Trojans*; Dion. Halicar. derives them from the Greeks†; and Plutarch informs us‡ that some people imagined that they were sprung from the Pelasgi. The fact is, they were a mixture of people collected out of Latium and the adjacent parts, which a variety of accidents had drawn together, to establish themselves on that mountainous region, in order to secure their own property, and plunder that of their neighbours. They were in all probability composed of Arcadians, Sabines, Latins, Hetruscans, Umbrians, Oscans, Pelasgi, &c.; and if so, their language must have been a mixture of the different dialects peculiar to all these discordant tribes.

* *Tit. Liv.* lib 1. cap 1. &c.
† *Antiq. Rom.* lib. i.
‡ *Vita Romul.*

The Latin language ought then to be a mingled mass of the Arcadian, that is, the Æolian || Greek, the Pelasgic, Hetruscan, and Celtic dialects. These jarring elements, like the people to whom they belonged respectively, gradually incorporated, and produced what was afterwards called the *Latin* tongue.

|| *Strabo,* lib v. *Dionys. Halicarn. Antiq.* lib i.

The Arcadians were a Pelasgic § tribe, and consequently spoke a dialect of that ancient Greek produced by the coalition of this tribe with the savage aborigines of Greece. This dialect was the ground-work of the Latin. Every scholar allows, that the Æolian Greek, which was strongly tinctured with the Pelasgic, was the model upon which the Latin language was formed. From this deduction it appears, that the Latin tongue is much more ancient than the modern Greek; and of course we may add, that the Greek, as it stood before it was thoroughly polished, bore a very near resemblance to that language. Hence we think we may conclude, that the knowledge of the Latin language is necessary in order to understand the Greek. Let us not then expect to find the real ingredients of the Greek tongue in the academic groves of Athens, or in Smyrna, or in Rhodope, or in Hæmos; but on the banks of the Tiber and on the fields of Laurentum.

§ *Strabo et Herodotus.*

A very considerable part of the Latin tongue was derived from the Hetruscan. That people were the masters of the Romans in every thing sacred. From them they learned the ceremonies of religion, the method of arranging games and public festivals, the art of divination, the interpretation of omens, the method of lustrations, expiations, &c. It would, we believe, be easy to prove, that the Pelasgi* and Hetrusci (x) were the same race of people; and if this was the case, their languages must have differed in their dialect only.

* *Thucydides,* lib vi.

The Umbrian or Celtic enters deeply into the composition of the Latin tongue. For proof of this, we need only appeal to *Pelloutier, Bullet's Memoires de la Langue Celtic, partie premiere, Abbé Pezron's Origin of Ancient Nations,* &c. Whether the old Celtic differed essentially from the Pelasgic and Hetruscan, would be a matter of curious investigation, were this a proper subject for the present article.

The Latin abounds with oriental words, especially Hebrew, Chaldaic, and Persian. These are certainly remains of the Pelasgic and Hetruscan tongues, spoken originally by people who emigrated from regions where those were parts of the vernacular language.—The

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(x) The Hetrusci were variously denominated by the Greeks and Romans. The former called them τυρσανοι; which was their true name, for they actually emigrated from Tarshish, or the western coast of Asia Minor, and consequently Herodotus every where calls them τυρσηνοι. The Æolians changed α into υ; hence in that dialect they were called τυρσηνοι, from *Tarsus*. The Romans styled them *Tusci*, probably from the Greek verb θυω, *sacrifico*, alluding to the skill which that people professed in the ceremonies of religion. They called their country *Hetruria*, we think from the Chaldaic word *heretum*, "a magician or sorcerer; a name deduced from their skill in divination.

Greeks, in polishing their language, gradually distorted and disfigured vast numbers of the rough eastern vocables, which made a very great part of it. (See the preceding section).

The Romans, of less delicate organs, left them in their natural state, and their natural air readily bewrays their original. We had collected a large list of Latin words still current in the east; but find that Thomassin † and Ogerius (y), and especially Mons. Gebelin, in his most excellent Latin Dictionary, have rendered that labour superfluous.

† Glossary.

In this language, too, there are not a few Gothic terms. How these found their way into the Latin, it is not easy to discover, unless, as Pelloutier supposes, the Celtic and Gothic languages were originally the same: or perhaps we may conjecture, that such words were part of a primitive language, which was at one time universal.

182 How far the Latin resembles the Greek.

There are, besides, in the Latin a great number of obsolete Greek words, which were in process of time obliterated, and others substituted in their room; so that, upon the whole, we are persuaded, that the most effectual method to distinguish the difference between the early and modern Greek, would be to compare the ancient Latin with the latter; there being, we imagine, very little difference between the ancient Greek and Latin in the earliest periods.

However that may be, it is certain that the Roman letters were the same with the ancient Greek.—*Formæ literis Latinis quæ veterrimis Græcorum*, says Tacitus ‡; and Pliny § says the same thing, and for the truth of his assertion he appeals to a monument extant in his own times.

‡ *Tacitus, Anal.* lib. ii.

§ *Nat Hist.* lib. vii. cap. 58.

These old Greek letters were no other than the Pelasgic, which we have shown from Diodorus Siculus (see preceding Section) to have been prior to the Cadmean. For the figure of these letters, see Astle, Postellus, Montfaucon, Palægraphia Græca, Mons. Gebelin, and our Plates XV. and XVI.

That the Latins borrowed the plan of their declensions from the Greeks, is evident from the exact resemblance of the terminations of the cases throughout the three similar declensions. In nouns of the first declension, the resemblance is too palpable to stand in need of illustration. In the second, the Greek genitive is ου. In Latin the *o* is thrown out, and the termination becomes *i*. In the Greek section, we have observed, that the sounds of ι and υ differed very little; therefore the Latins used ι instead of υ. The Latin dative ends in *o*, which is the Greek dative, throwing away ι *subscriptum*, which was but faintly sounded in that language. No genuine Greek word ended in μ or *m*.

The Hellenes seemed to have abhorred that bellowing liquid; it is, however, certain that they imported it from the east, as well as the other letters, and that they employed it in every other capacity, except in that of closing words. In the termination of flexions, they changed it into ν.

The Latins retained *m*, which had been imported to them as a terminating letter at an era before the Greek language had undergone its last refinement.—Hence the Latin accusative in *um*, instead of the Greek ον. The vocative case, we imagine, was in this declension originally like the nominative. The Latins have no dual number, because, in our opinion, the Æolian dialect, from which they copied, had none. It would be, we think, a violent stretch of etymological exertion, to derive either the Latin genitive plural of the second declension from the same case of the Greek, or that of the latter from the former; we therefore leave this anomaly, without pretending to account for its original formation. The third declensions in both languages are so exactly parallel, that it would be superfluous to compare them. The dative plural here is another anomaly, and we think a very disagreeable one, which we leave to the conjectures of more profound etymologists.

For the other peculiarities of Latin nouns, as they are nearly similar to those of the Greek, we must beg leave to remit our readers to that section for information.

183 Deficiency of articles.

The Latins have no articles, which is certainly a defect in their language. The Pelasgic, from which they copied, had not adopted that word in the demonstrative sense. Homer indeed seldom uses it; and the probability is, that the more early Greek used it less frequently, at least in the sense above mentioned. Thus in Latin, when I say, *video hominem*, it is impossible to find out by the bare words whether the word *hominem* intimates "a man," or "the man;" whereas in Greek it would be Βλεπω ἀνθρωπον, *I see a man*, Βλεπω τον ανθρωπον, *I see the man*. Hence the first expression is indefinite, and the second definite.

184 Origin of the substantive verb.

The substantive verb *sum* in Latin seems to be partly formed from the Greek and partly not. Some of the persons of the present tense have a near resemblance to the Greek verb ἐω or ἐιμι, while others vary widely from that archetype. The imperfect præterite and præterperfect have nothing common with the Greek verb, and cannot, we think, be forced into an alliance with it. The future *ero*, was of old *eso*, and is indeed genuine Greek. Upon the whole, in our apprehension, the Latin substantive verb more nearly resembles the Persian verb *hesten* than that of any other language we are acquainted with.

185 and of other verbs.

From what exemplar the Latin verbs were derived, is not, we think, easily ascertained. We know that attempts have been made to deduce them all from the Æolic Greek, and that the Romans themselves were extremely fond of this chimera; but the almost numberless irregularities, both in the formation and conjugation of their verbs, induce us to believe that only a part of them were formed upon that model. We are apt to think that the terminations in *bam*, *bas*, *bat*, *bamus*, &c. are produced by their union with a fragment of some obsolete verb, which is now wholly lost. In the verb *amo*, e. g. we are sure that the radix *am* is the Hebrew word *mother*; but how *am-abam*, *am-abo*, *am-arem* were fabricated, and connected with the radical *am*, is not so easily determined. That Latin verbs are composed of an inflexible radix and another flexible verb, as well as the Greek, cannot be doubted; but what this flexible auxiliary was, we think, cannot now be clearly ascertained. It is not altogether improbable that such parts of the verbs as deviate from the Greek archetype were supplied by fragments of the verb *ha*, which pervades all the branches of the Gothic language, and has, we think, produced the Latin verb *habeo*. When the Greeks began to etymologize, they seldom overpassed the verge of their own language: the Latins pursued nearly the same course. If their own language presented a plausible etymology, they embraced it; if not, they immediately had recourse to the Greek; and this was the *ne plus ultra* of their etymological researches. Cicero, Quintilian, Festus, &c. and even Varro, the most learned of all the Romans, stop here; all beyond is either doubt or impenetrable darkness. Their opinion above mentioned we offer only as a conjecture; the decision we leave to more able critics.

(y) *Græca et Latina lingua Hebraizantes*, Venice 1763. If these books are not at hand, Dr Littleton's Dictionary will, in a good measure, supply their place.

186
Deficiencies in Latin verbs.

The want of aorists or indefinite tenses seems to us a palpable defect in the Latin language. The use of these among the Greeks entitled the writer to express the specific variations of time with more accuracy and precision than the Latins, who never attempted to specify them by any other tenses but the imperfect and pluperfect. Indeed we should imagine, that both the Greeks and Latins were much inferior to the English in this respect. The Latin word *lego*, for example, may be translated into English three different ways: 1st, *I read;* 2d, *I do read;* 3d, *I am reading*.

187
Irregularities in the conjugations.

The Latins, in reducing verbs to their four conjugations, formed their inflexions in a very irregular manner. Many very of the first class inflect their præterite and supine like those of the second: thus *domo*, instead of giving *avi* and *atum*, has *ui* and *itum*, like *monui* and *monitum*. Again, not a few verbs of the third conjugation have *ivi* and *atum*, as if they belonged to the fourth; e. g. *peto*, *petivi*, *petitum*. Then, some verbs have *io* in the present, *ivi* in the præterite, and *itum* in the supine, while, contrary to the rules of analogy, they in reality belong to the third: such are *cupio*, *cupivi*, *cupitum*, *cupere*, &c. Some verbs of the second conjugation have their præterite and supine as if they belonged to the third; thus, *jubeo*, *jussi*, *jussum*, *jubere; augeo*, *auxi*, *auctum*, *augere*. Some verbs, which are actually of the fourth conjugation, have their præterite and supine as if they were of the third; thus *sentio*, *sensi*, *sensum*, *sentire; haurio*, *hausi*, *haustum*, *haurire*, &c. If these are not manifest irregularities, we cannot say what deserves the name. The fact seems to stand thus: The Romans were originally a banditti of robbers, bankrupts, runaway slaves, shepherds, husbandmen, and peasants of the most unpolished character. They were engaged in perpetual broils and quarrels at home, and seldom enjoyed repose abroad. Their profession was robbery and plunder. Like old Ishmael, their hands were against every man, and every man's hand against them. In such a state of society no time was left for cultivating the sciences. Accordingly the arts of war and government were their sole profession. This is so true, that their own poet characterizes them in the following manner:

Excudunt alii spirantia mollius æra, &c.

188
The Latin deficient in participles.

Another blemish in the Latin tongue is occasioned by its wanting a participle of the præterite sense in the active voice. This defect is perpetually felt, and is the cause of an awkward circumlocution wherever it happens to present itself. Thus, "The general having crossed the river drew up his army;" *Imperator, cum transiisset flumen, aciem instruxit*. Here *cum transiisset flumen* is a manifest circumlocution, which is at once avoided in the Greek ὁ ἡγεμων περασας τον ποταμον, &c. This must always prove an incumbrance in the case of active intransitive verbs. When active deponent verbs occur, it is easily avoided. Thus, "Cæsar having encouraged the soldiers, gave the signal for joining battle;" *Cæsar cohortatus milites, prœlii committendi signum dedit*.

Another palpable defect in this language arises from the want of a participle of the present passive. This again must produce an inconveniency upon many occasions, as will be obvious to every Latin student almost every moment.

189
Supines and gerunds.

The two supines are universally allowed to be substantive nouns of the fourth declension. How these assumed the nature of verbs it is not easy to determine. When they are placed after verbs or nouns, the matter is attended with no difficulty; but how they should acquire an active signification, and take the case of the verb with which they are connected, implies, we should think, a stretch of prerogative.

The Latin gerunds form another unnatural anomaly. Every Latin scholar knows that those words are nothing but the neuters of the participles of the future passive. The fabricators of the Latin tongue, however, elevated them from their primary condition, giving them upon many occasions an active signification. In this case we must have recourse to

——————*Si volet usus,*
Quem penes arbitrium est et jus et norma loquendi.

Another inconveniency, perhaps more severely felt than any of the preceding, arises from the want of the use of the present participle of the verb *sum*. Every body knows what a conveniency is derived from the frequent use of the participle ων in Greek; and indeed it appears to us somewhat surprising that the Latins neglected to introduce the participle *ens* into their language. In this we believe they are singular. Here again a circumlocution becomes necessary in such a case as the following: "The senate being at Rome, passed a decree." Instead of saying *senatus ens Romæ, legem tulit*, we are obliged to say *cum senatus Romæ esset*, &c. If the words *ens* or *existens* had been adopted, as in the Greek, this odious circumlocution would have been avoided.

Many other defects of the like kind will occur to every person who shall choose to search for them, and those in the most approved classical authors. Perhaps our mentioning so many may be deemed invidious by the admirers of that language; but we write from conviction, and that must be our apology.

190
Different genius of the Latin and Greek languages.

If one take the trouble to compare the structure of the Greek and Latin languages, he will, we think, quickly be convinced that their characteristic features are extremely different. The genius of the former seems easy and natural; whereas that of the latter, notwithstanding the united efforts of poets, orators, and philosophers, still bears the marks of violence and restraint. Hence it appears that the Latin tongue was pressed into the service, and compelled almost against its will to bend to the laws of the Grecian model. Take a sentence of

Hebrew, Chaldean, Arabian, &c. and try to translate it into Greek without regarding the arrangement of the words, and you will find it no difficult attempt; but make the same trial with respect to the Latin, and you will probably find the labour attended with considerable difficulty. To translate Greek into English is no laborious task; the texture of the two languages is so congenial, that the words and phrases, and even the idiomatic expressions, naturally slide into each other. With the Latin the case is quite otherwise; and before elegant English can be produced, one must deviate considerably from the original. Should we attempt to translate a piece of English into Greek, and at the same time into Latin, the translation of the former would be attended with much less difficulty than that of the latter, supposing the translator equally skilled in both languages.

191 Causes of this difference.

This incongruity seems to spring from the following cause. Before any man of considerable abilities, either in the capacity of a poet, grammarian, or rhetorician, appeared at Rome, the language had acquired a strong and inflexible tone, too stubborn to be exactly moulded according to the Grecian standard. After a language has continued several centuries without receiving a new polish, it becomes like a full grown tree, incapable of being bent to the purposes of the mechanic. For this reason, it is highly probable, that the tongue in question could not be forced into a complete assimilation with the Greek. Notwithstanding all these obstructions, in process of time it arrived at such an exalted pitch of perfection, as to rival, perhaps to excel, all the other European languages, the Greek only excepted. Had men of the taste, judgment, and industry of Ennius, Plautus, Terence, Cicero, and the worthies of the Augustan age, appeared in the early stages of the Roman commonwealth, we may believe that their language would have been thoroughly reduced to the Grecian archetype, and that the two dialects might have improved each other by a rivalship between the nations who employed them.

Without pretending to entertain our readers with a pompous and elaborate account of the beauties of that imperial language which have been detailed by writers almost without number, we shall endeavour to lay before them as briefly as possible its pristine character, the steps and stages by which it gradually rose to perfection, the period when it arrived at the summit of its excellence, and by what means it degenerated with a rapid career till it was lost among those very people to whom it owed its birth.

192 The Latin tongue composed chiefly of Pelasgic and Celtic words.

We have observed already, that the Latin tongue was a *colluvies* of all the languages spoken by the vagrant people who composed the first elements of that republic. The prevailing dialects were the Pelasgic or Hetruscan, which we think were the same; and the Celtic, which was the aboriginal tongue of Italy. Hence the primary dialect of the Romans was composed of discordant materials, which in our opinion never acquired a natural and congenial union. Be that as it may, this motley mixture was certainly the original dialect of the Romans. The Pelasgic or Hetruscan part of it retained a strong tincture of the oriental style. The Celtic part seems to have been prevalent, since we find that most of the names of places (z), especially in the middle and northern parts of Italy, are actually of Celtic original. It is therefore clear that the style of the first Romans was composed of the languages above mentioned. Who those first Romans were, we believe it is impossible to determine with any degree of certainty. The Roman historians afford us as little information upon that subject, as their etymologists do upon the origin of their language. Their most celebrated writers upon this point were Ælius Gallus, Quintus Cornificius, Nonius Marcellus, Festus, and some others of less note. At the head of these we ought to place Terentius Varro, whom Cicero styles the most learned of all the Romans. From these writers we are to expect no light. Their etymologies are generally childish and futile. Of the language of the most ancient Romans we can only reason by analogy; and by that rule we can discover nothing more than what we have advanced above.

In the first place we may rest assured that the dual number, the articles, the participle above mentioned, the aorists, and the whole middle-voice, never appeared in the Latin tongue; and accordingly were not current in those languages from which it was copied, at least at the time when it was first fabricated.

Besides all this, many circumstances concur to make it highly probable that, in the earliest period of the language, very few inflexions were introduced. 1st, When the Pelasgi left Greece, the Greek language itself was not fully polished. 2d, The Arcadians were never thoroughly cultivated. They were a rustic pastoral people, and little minded the refinements of a civilized state; consequently the language they brought into Italy at that era must have been of a coarse and irregular contexture. 3d, When the Thessalian * Pelasgi arrived in Italy about the time of Deucalion, the Greek itself was rude and barbarous; and, which is still of more consequence, if we may credit Herodotus quoted in the former section, that people had never adopted the Hellenic tongue. Hence it appears, that the part of the Latin language derived from the Pelasgic or Hetruscan (for these we believe to have been the same) must have taken a deep tincture from the oriental tongue. (See preceding Section). If we may judge of the Celtic of that age by that of the present, the same character must likewise have distinguished its structure.

193 Hence little inflected in its original state.

From these circumstances, we think it appears that the earliest language of the Romans was very little diversified with inflections. It nearly resembled the oriental exemplar, and consequently differed widely from the modern Latin. The effect of this was, that the modern Romans could not understand the language of their early progenitors. Polybius †, speaking of the earliest treaty between the Romans and Carthaginians, makes the following observation: "Believe me (says he), the Roman language has undergone so many changes since that time

* *Dionys. Halicarn.* lib. i.

† Lib. 3. *sub initio.*

(z) For proof of this our readers may consult Abbé Pezron, Pelloutier, Bullet's *Mem.* Gebelin, *Pref. Dict. Lat.* and many others.

time (A) to the present, that even those who are most deeply skilled in the science of antiquities cannot understand the words of that treaty but with the greatest difficulty."

From this source we make no doubt has flowed that vast number of oriental words with which the Latin language is impregnated. These were originally inflexible. like their brethren of the east. They were not disguised as they now are with prefixes, affixes, metatheses, syncopas, antitheses, &c. but plain and unadorned in their natural dress.

194 Bent afterwards into the Grecian model.

After the Romans became acquainted with the Æolian Greeks, who gradually seized upon both coasts of Italy towards the south, which they called *Magna Græcia*, they began to affect a Grecian air, and to torture their language into that foreign contexture. It appears, however, that at first the Grecian garb sat rather awkwardly, and several marks of violence were easily discerned. The most ancient specimen of this kind that we can recollect consists of the remains of the *twelve tables*. Here every thing is rude and of a clumsy cast; for though by this time considerable progress had been made in refinement, and the language of Rome had begun to appear in a Grecian uniform, still those changes were not altogether natural. Soon after appeared Marcus Fabius Pictor and Sisenna; historians often quoted by Livy, but whose works are long since irrecoverably lost. The Fasti Capitolini are often mentioned; but they too perished in the burning of the Capitol during the civil wars between Marius and Sylla. Had those monuments escaped the ravages of time, we should have been able to mark the progress of the Latin tongue from stage to stage, and to ascertain with the greatest accuracy its gradual configuration in the course of its progress towards the Grecian standard. We must therefore leave the Latin tongue during those periods rude and barbarous, and descend to others better known and more characteristically marked. Those commenced after that

Græcia capta ferum victorem cepit, et artes
Intulit agresti Latio.

195 The principal authors by whom it was gradually polished.

In this period we find Ennius, who wrote a Roman history in hexameter verse in 18 books, which he called *Annals;* most part of which is now lost. He likewise translated *Euhemerus de Origine Deorum;* a work often mentioned by the Christian fathers in their disputes with the Pagans. It is sometimes quoted by Cicero. Then followed Caius Lucilius the famous satirist, and a number of other writers, such as Accius, Valerius, Ædituus, Alpinus, &c. whose fragments were published by the Stephens, Paris, 1564. All these imitated the writers of Greece or translated from them. By their perseverance and active exertions, the spirit of these authors was transfused into the Latin tongue, and its structure accommodated to the Grecian plan.

Plautus and Terence, by translating the comedies of Menander and Diphilus into their own language, taught the Latin muses to speak Attic Greek. To speak that language was then the *ton* of the times, as it is now with us to chatter French. Greek tutors were retained in every reputable family; and many Romans of the first rank were equally qualified to speak or write both in Greek and Latin. The original jargon of Latium was now become obsolete and unintelligible; and Cato the Ancient condescended to learn the Greek language at 80.

196 The golden age of Rome.

To pretend to enumerate the various, and we may add inimitable, examples of the Augustan or golden age of the Roman tongue, would be an insult to the understanding of our readers: we shall only take the liberty to translate a few lines from a most excellent historian *, who, had his honesty been equal to his judgment, might have rivalled the most celebrated writers of his country. Having observed, that the Greek authors, who excelled in every province of literature, had all made their appearance nearly about the same space of time, confined within very narrow limits, he adds, "Nor was this circumstance more conspicuous among the Greeks than among the Romans; for unless we go back to the rough and unpolished times, which deserve commendation only on account of their invention, the Roman tragedy is confined to Accius and the period when he flourished. The charming wit of Latin elegance was brought to light by Cecilius, Terentius, and Afranius, nearly in the same age. As for our historians (to add Livy also to the age of the former), if we except Cato and some old obscure ones, they were all confined to a period of 80 years; so neither has our stock of poets extended to a space much backward or forward. But the energy of the bar, and the finished beauty of prose eloquence, setting aside the same Cato (by leave of P. Crassus, Scipio, Lælius, the Gracchi, Fannius, and Ser. Galba, be it spoken), broke out all at once under Tully the prince of his profession; so that one can be delighted with none before him, and admire none except such as have either seen or were seen by that orator."

197 Causes of the degeneracy of the Latin tongue.

From this quotation it plainly appears, that the Romans themselves were convinced of the short duration of the golden age of their language. According to the most judicious critics, it commenced with the era of Cicero's oratorical productions, and terminated with the reign of Tiberius, or perhaps it did not reach beyond the middle of that prince's reign. It is generally believed that eloquence, and with it every thing liberal, elevated, and manly, was banished Rome by the despotism of the Cæsars. We imagine that the transition was too instantaneous to have been entirely produced by that unhappy cause. Despotism was firmly established among the Romans about the middle of the reign of Augustus; and yet that period produced such a group of learned men as never adorned any other nation in so short a space of time. Despotism, we acknowledge, might have affected the eloquence of the bar; the noble and important objects which had animated the republican orators being now no more: but this circumstance could not affect poetry, history, philosophy, &c. The style employed upon these subjects did not feel the fetters of despotism. The age of Louis XIV. was the golden period of the French tongue; and we think that age produced a race of learned men, in every department superior in number and equal in genius to the literati who flourished under the noble and envied constitution of Britain during the same age, though the latter is universally allowed to have been the golden period of this country. The British isles, we hope, enjoy still as much liberty as ever; yet we believe few people will aver, that the writers of the present age are equal either in style or in genius to that noble group who flourished from the middle of the reign of Charles I. to the middle of the reign of George II.; and here despotism is quite unconcerned.

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* *Velleius Paterculus*, lib. i. cap. ult.

(A) This treaty, according to the same historian, was concluded in the consulship of Lucius Junius Brutus and Marcus Valerius, 28 years before Xerxes made his descent upon Greece.

In the east the same observation is confirmed. The Persians have long groaned under the Mohammedan yoke; and yet every oriental scholar will allow, that in that country, and under the most galling tyranny, the most amazing productions of taste, genius, and industry, that ever dignified human nature, have been exhibited. Under the Arabian caliphs, the successors of Mohammed, appeared writers of a most sublime genius, though never was despotism more cruelly exercised than under those fanatics. The revival of letters at the era of the Reformation was chiefly promoted and cherished by petty despotical princes.

We cannot therefore be persuaded, that the despotism of the Cæsars banished eloquence and learning from Rome. Longinus indeed has attributed this misfortune to that cause, and tells us, *θρεψαι τε γαρ ἱκανη τα Φρονηματα των Μεγαλοφρονων ἡ* ΕΛΕΥΘΕΡΙΑ, &c. "It is liberty that is formed to nurse the sentiments of great geniuses, to push forward the propensity of contest, to inspire them with hopes, and the generous ambition of being the first in rank." When Longinus wrote this, he did not reflect that he himself was a striking instance of the unsoundness of his observation.

198
The writers of the silver age greater masters of science than their predecessors.

As to science, the fact is undoubtedly on the other side. That Seneca was superior to Cicero in philosophy, cannot be reasonably contradicted. The latter had read, and actually abridged, the whole extent of Grecian philosophy: this displayed his reading rather than his learning. The former had addicted himself to the stoic sect; and though he does not write with the same flow of eloquence as Tully, he thinks more deeply and reasons more closely. Pliny's Natural History is a wonderful collection, and contains more useful knowledge than all the writings of the Augustan age condensed into one mass. We think the historical annals of Tacitus, if inferior to Livy in style and majesty of diction, much superior in arrangement and vigour of composition. In short, we discover in these productions a deep insight into human nature, an extensive knowledge of the science of government, a penetration which no dissimulation could escape, together with a sincere attachment to truth both with respect to events and characters; nor is he inferior in the majesty, energy, and propriety of his harangues, wherever an equal opportunity presents itself. Quintilian, Pliny the younger, Suetonius, Petronius Arbiter, and Juvenal, deserve high esteem; nor are they inferior to their immediate predecessors. We think there is good reason to conclude, that the loss of liberty among the Romans did not produce the extinction of eloquence, science, elevation of sentiment, or refinement of taste. There were, we believe, other circumstances which chiefly contributed to produce that revolution.

The same Velleius Paterculus whom we have quoted assigns some plausible and very judicious reasons for this catastrophe. "Emulation (says he) is the nurse of genius; and one while envy, and another admiration, fires imitation. According to the laws of nature, that which is pursued with the greatest ardour mounts to the top: but to be stationary in perfection is a difficult matter; and by the same analogy, that which cannot go forward goes backward. As at the outset we are animated to overtake those whom we deem before us, so when we despair of being able to overtake or to pass by them, our ardour languishes together with our hope, and what it cannot overtake it ceases to pursue; and leaving the subject as already engrossed by another, it looks out for a new one upon which to exert itself. That by which we find we are not able to acquire eminence we relinquish, and try to find out some object *elsewhere* upon which to employ our intellectual powers. The consequence is, that frequent and variable transitions from subject to subject proves a very great obstacle to perfection in any profession."

This perhaps was the case with the Romans. The heroes of the Augustan age had borne away the prize of eloquence, of history, of poetry, &c. Their successors despaired of being able to equal, much less to surpass them, in any of these walks. They were therefore laid under the necessity of striking out a new path by which they might arrive at eminence. Consequently Seneca introduced the *stile coupé*, as the French call it; that is, a short, sparkling, figurative diction, abounding with antitheses, quaintnesses, witticisms, embellished with flowers and meretricious ornaments; whereas the style of the Augustan age was natural, simple, solid, unaffected, and properly adapted to the nature of the subject and the sentiments of the author.

The historian Sallust laid the foundation of the unnatural style above mentioned. Notwithstanding all the excellencies of that celebrated author, he everywhere exhibits an affectation of antiquity, an antithetical cast, an air of austerity, an accuracy, exactness, and regularity, contrary to that *air degagé* which nature displays in her most elaborate efforts. His words, his clauses, seem to be adjusted exactly according to number, weight, and measure, without excess or defect. Velleius Paterculus imitated this writer; and, as is generally the case with imitators, succeeded best in those points where his archetype had failed most egregiously. Tacitus, however excellent in other respects, deviated from the Augustan exemplars, and is thought to have imitated Sallust; but affecting brevity to excess, he often falls into obscurity. The other contemporary writers employ a cognate style; and because they have deviated from the Augustan standard, their works are held in less estimation, and are thought to bear about them marks of degeneracy.

That degeneracy, however, did not spring from the despotic government under which these authors lived, but from that affectation of singularity into which they were led by an eager but fruitless desire of signalizing themselves in their mode, as their predecessors had done in theirs. But the mischiefs of this rage for innovation did not reach their sentiments, as it had done their style; for in that point we think they were so far from falling below the measure of the writers of the former age, that in many instances they seem to have surpassed them.

With respect to sentiment and mental exertions, the authors in question preserved their vigour, till luxury and effeminacy, in consequence of power and opulence, enervated both the bodies and minds of the Romans. The contagion soon became universal; and a listlessness, or intellectual torpor, the usual concomitant of luxury, spread indolence over the mental faculties, which rendered them not only averse to, but even incapable of, industry and perseverance. This lethargic disposition of mind seems to have commenced towards the conclusion of the silver age; that is, about the end of the reign of Adrian. It was then that the Roman eagle began to stoop, and the genius of Rome, as well in arts as in arms, began to decline. Once more, the declension of the intellectual powers of the writers of that nation did not arise from the form of the government, but from the causes above specified.

As the Roman genius, about that period, began to decline, so the style of the silver age was gradually vitiated with barbarisms and exotic forms of speech. The multitudes of barbarians who flocked to Rome from all parts of the empire; the ambassadors of foreign princes, and often the princes themselves, with their attendants; the prodigious numbers of slaves who were entertained in all the considerable families of the capital, and over all Italy; the frequent commerce which the Roman armies upon the frontiers carried on with the barbarians; all concurred to vitiate the Latin tongue, and to interlard it with foreign words and idioms. In such circumstances, it was impossible for that or any other language to have continued pure and untainted.

This vitiated character both of style and sentiment became more and more prevalent, in proportion as it descended from the reign of Adrian towards the era of the removal of the imperial seat from Rome to Constantinople. Then succeeded the iron age, when the Roman language became absolutely rude and barbarous.

199 Writers of great talents during the silver and brazen ages.

Towards the close of the silver, and during the whole course of the brazen age, there appeared, however, many writers of no contemptible talents. The most remarkable was Seneca the stoic, the master of Nero, whose character both as a man and a writer is discussed with great accuracy by the noble author of the *Characteristics*, to whom we refer our readers.

About the same time lived Persius the satirist, the friend and disciple of the stoic Cornutus; to whose precepts he did honour by his virtuous life; and by his works, though small, he showed an early proficiency in the science of morals.

Under the mild government of Adrian and the Antonines lived Aulus Gellius, or (as some call him) Agellius; an entertaining writer in the miscellaneous way, well skilled in criticism and antiquity. His works contain several valuable fragments of philosophy, which are indeed the most curious part of them.

With Aulus Gellius we may rank Macrobius; not because he was a contemporary (for he is supposed to have lived under Honorius and Theodosius), but from his near resemblance in the character of a writer. His works, like those of the other, are miscellaneous; filled with mythology and ancient literature, with some philosophy intermixed.

In the same age with Aulus Gellius flourished Apuleius of Madaura in Africa; a Platonic writer, whose matter in general far exceeds his perplexed and affected style, too conformable to the false rhetoric of the age in which he lived.

Boethius was descended from one of the noblest of the Roman families, and was consul in the beginning of the sixth century. He wrote many philosophical works; but his ethic piece on the Consolation of Philosophy deserves great encomiums, both for the matter and the style; in which latter he approaches the purity of a far better age than his own. By command of Theodoric king of the Goths this great and good man suffered death; and with him the Latin tongue, and the last remains of Roman dignity, may be said to have sunk in the western world.

There were besides a goodly number both of poets and historians who flourished during this period; such as Silius Italicus, Claudian, Ausonius, &c. poets and historians to a very great number, for whom our readers may consult *Joh. Alberti Fabricii Bibl. Lat.*

200 Elegant ecclesiastical writers in Latin.

There flourished, too, a number of ecclesiastical writers, some of whom deserve great commendation. The chief of these is Lactantius, who has been deservedly dignified with the title of the *Christian Cicero*.

The Roman authors amount to a very small number in comparison of the Greek. At the same time, when we consider the extent and duration of the Roman empire, we are justly surprised to find so few writers of character and reputation in so vast a field. We think we have good reason to agree with the prince of Roman poets in the sentiment already quoted.

201 Excellency and usefulness of the Latin tongue.

Upon the whole, the Latin tongue deserves our attention beyond any other ancient one now extant. The grandeur of the people by whom it was spoken; the lustre of its writers; the empire which it still maintains among ourselves; the necessity we are under of learning it in order to obtain access to almost all the sciences, nay even to the knowledge of our own laws, of our judicial proceedings, of our charters; all those circumstances, and many others too numerous to be detailed, render the acquisition of that imperial language in a peculiar manner at once improving and highly interesting. Spoken by the conquerors of the ancient nations, it partakes of all their revolutions, and bears continually their impression. Strong and nervous while they were employed in nothing but battles and carnage, it thundered in the camps, and made the proudest people to tremble, and the most despotic monarchs to bend their stubborn necks to the yoke. Copious and majestic, when, weary of battles, the Romans inclined to vie with the Greeks in science and the graces, it became the learned language of Europe, and by its lustre made the jargon of savages disappear who disputed with it the possession of that quarter of the globe. After having controuled by its eloquence, and humanized by its laws, all those people, it became the language of religion. In short, the Latin language will be studied and esteemed as long as good sense and fine taste remain in the world.

SECT. IX. *Celtic, Gothic, and Sclavonian Languages.*

§ 1. *Of the Celtic Language.*

In treating of the origin of the Latin tongue (see Sect. VIII.), we observed that a great part of it is derived from the Celtic. We shall now endeavour to give some account of the origin and extent of that ancient language; still leaving the minutiæ to grammars and dictionaries, as we have done with respect to the other dialects which have fallen under our consideration. Our candid readers, it is hoped, will remember, that we are acting in the character of philologers, not in that of grammarians and lexicographers.

202 Origin of the Celts,

The descendants of Japhet having peopled the western parts of Asia, at length entered Europe. Some broke into that quarter of the globe by the north, others found means to cross the Danube near its mouth. Their posterity gradually ascended towards the source of that river; afterwards they advanced to the banks of the Rhine, which they passed, and thence spread themselves as far as the Alps and the Pyrenees.

These people, in all probability, were composed of different families; all, however, spoke the same language; their manners and customs bore a near resemblance; there was no variety among them but that difference which climate always introduces. Accordingly they were all known, in the more early times, by the general name of *Celto-scythæ*. In process of time, becoming exceedingly numerous, they were divided into several nations, which were distinguished by different names and territorial appellations. Those who inhabited that large country bounded by the ocean, the Mediterranean, the Rhine, the Alps, and the Pyrenees, were denominated *Gauls* or *Celts*. These people multiplied so prodigiously in the space of a few centuries, that the fertile regions which they then occupied could not afford them the means of subsistence. Some of them now passed over into Britain; others crossed the Pyrenees, and formed settlements in the northern parts of Spain. Even the formidable barriers of the Alps could not impede the progress of the Gauls: they made their way into Italy, and colonized those parts which lie at the foot of the mountains, whence they extended themselves towards the centre of that rich country.

203 part of whom were denominated Gauls.

By this time the Greeks had landed on the eastern coast of Italy, and founded numerous colonies in those parts. The two nations vying as it were with each other in populousness, and always planting colonies in the course of their progress, at length rencountered about the middle of the country. This central region was at that time called *Latium*. Here the two nations formed one society, which was called *the Latin people*. The languages of the two nations were blended together; and hence, according to some, the Latin is a mixture of Greek and Gaelic.

As the Gauls were a brave and numerous people, they certainly maintained themselves in their pristine possessions, uninvaded, unconquered, till their civil animosities and domestic quarrels exposed them as a prey to those very Romans whom they had so often defeated, and sometimes driven to the brink of destruction. They were not a people addicted to commerce; and upon the whole, considering their situation both in their primary seats and afterwards in Italy, they had little temptation or opportunity to mingle with foreigners. Their language, therefore, must have remained unmixed with foreign idioms. Such as it was when they settled in Gaul, such it must have continued till the Roman conquests. If therefore there is one primitive language now existing, it must be found in the remains of the Gaelic or Celtic. It is not, then, surprising, that some very learned men, upon discovering the coincidence of very great numbers of words in some of the Greek dialects with other words in the Celtic, have been inclined to establish a strict affinity between those languages. The ancient Pelasgic and the Celtic at least must have nearly resembled each other, admitting a dialectical difference only, and that discrimination which climate and a long period of time must always produce.

204 Resemblance between their language and that of the Pelasgi.

Some have thought that the Gauls lost the use of their native language soon after their country was conquered by the Romans; but *Monsieur Bullet*, in his *Memoires de la Langue Celtique*, has proved almost to a demonstration, that the vulgar among those people continued to speak it several centuries after that period. When a great and populous nation has for many ages employed a vernacular tongue, nothing can ever make them entirely relinquish the use of it, and adopt unmixed that of their conquerors.

Many learned men, among whom is the lexicographer above mentioned, have shown that all the local names in the north of Italy are actually of Celtic extraction. These names generally point out or describe some circumstances relating to the nature of their situation: such as exposure, eminence, lowness, moistness, dryness, coldness, heat, &c. This is a very characteristic feature of an original language; and in the Celtic it is so prominent, that the Erse names of places all over Scotland, are, even to this day, peculiarly distinguished by this quality. We have heard a gentleman, who was well skilled in the dialect of the Celtic still spoken in the Highlands of Scotland, propose to lay a bet at very great odds, that if one should pronounce the name of any village, mountain, river, gentleman's seat, &c. in the old Scottish dialect, he should be able, by its very name, to give a pretty exact description of its local situation.

To discover the sources from which the Celtic tongue is derived, we must have recourse to the following expedients.

1. We must consult the Greek and Latin authors, who have preserved some Gaelic or Celtic terms in their writings.

2. We must have recourse to the Welsh and *Basse Bretagne* dialects; in which, indeed there are many new words, but these are easily distinguished from the primitive stock.

3. If one would trace another source of the Celtic, he must converse with the country people and peasants, who live at a distance from cities, in those countries where it was once the vernacular tongue. We have been credibly informed, that a Highland gentleman crossing the Alps for Italy, accidentally fell in with an old woman, a native of those parts, who spoke a language so near akin to his native Erse, that he could understand her with little difficulty; and that she on the other hand, understood most of his words. That an event of this nature should actually take place is by no

means surprising, when we consider that the Erse spoken in the Highlands of Scotland is perhaps the most genuine remnant of the Celtic now existing, and at the same time reflect that there may be some remote cantons among those wild and inaccessible mountains, the Alps, where some remains of that tongue may still be preserved.

205
The most genuine remains of the Celtic in the Highlands of Scotland.

4. We have said that the most genuine remains of the Gaelic tongue are to be found in the Highlands of Scotland; and the reason is obvious. The Scottish Highlanders are the unmixed unconquered posterity of the ancient Britons, into whose barren domains the Romans never penetrated; not, we imagine, because they were not able, since they subdued both North and South Wales, equally inaccessible, but because they found no scenes there either to fire their ambition or allure their avarice. Amidst all the revolutions that from time to time shook and convulsed Albion, those mountainous regions were left to their primitive lords, who, like their southern progenitors, hospitable in the extreme, did not, however, suffer strangers to reside long among them. Their language, accordingly, remained unmixed, and continues so even unto this day, especially in the most remote parts and unfrequented islands.

The Norwegians subdued the western islands of Scotland, at a time when the Scottish monarchy was still in its minority. They erected a kind of principality over them, of which the isle of Man was the capital. Though they maintained the sovereignty of those islands for some centuries, built many forts, and strengthened them with garrisons, and in fine were the lawgivers and administrators of justice among the natives; yet we have been informed by the most respectable authority, that there is not at this day a single vocable of the Norse or Danish tongue to be found among these islanders. This fact affords a demonstration of that superstitious attachment with which they were devoted to their vernacular dialects.

206
The Welsh dialect not pure, nor the Irish.

The Welsh dialect cannot, we think, be pure and unsophisticated. The Silures were conquered by the Romans, to whom they were actually subject for the space of three centuries. During this period a multitude of Italian exotics must have been transplanted into their language; and indeed many of them are discernible at this day. Their long commerce with their English neighbours and conquerors hath adulterated their language, so that a great part of it is now of an English complexion. The Irish is now spoken by a race of people whose morality and ingenuity is nearly upon a level. Their latest historians have brought them from the confines of Asia, through a variety of adventures, to people an island *extra anni solisque vias*. However this genealogical tale may please the people for whom it was fabricated, we may still suspect that the Irish are of Celtic extraction, and that their forefathers emigrated from the western coast of Britain at a period prior to all historical or even traditional annals. Ireland was once the *native land of saints*. The chief actors on this sacred stage were Romanists, and deeply tinctured with the superstition of the times. They pretended to improve the language of the natives; and whatever their success was, they improved it in such a manner as to make it deviate very considerably from the original Celtic; so that it is not in Ireland that we are to look for the genuine characters of the dialect under consideration.

207
Coincidence between the Celtic and Phœnician.

Though the Hibernian tongue, in our opinion, differs considerably from the original Celtic, some very ingenious essays have been lately published by the learned and laborious members of the *Antiquarian Society of Dublin;* in which the coincidence of that tongue with some of the oriental dialects, has been supported by very plausible arguments. In a dissertation published in the year 1772, they have exhibited a collection of *Punico-Maltese* words compared with words of the same import in Irish, where it must be allowed the resemblance is palpable. In the same dissertation they have compared the celebrated *Punic* scene in Plautus with its translation into the Irish; in which the words in the two languages are surprisingly similar. If those criticisms are well founded, they will prove that the Celtic is coeval and congenial with the most ancient languages of the east; which we think highly probable. Be that as it may, the Danes and Norwegians formed settlements in Ireland; and the English have long been sovereigns of that island. These circumstances must have affected the vernacular idiom of the natives; not to mention the necessity of adopting the language of the conquerors in law, in sciences, in the offices of religion.

The inhabitants of the highlands and islands of Scotland are the descendants of those Britons who fled from the power of the Romans, and sheltered themselves among the fens, rocks, and fastnesses of those rugged mountains and sequestered glens. They preferred those wastes and wilds, with liberty and independence, to the pleasant and fertile valleys of the south, with plenty embittered by slavery. They no doubt carried their language along with them; that language was a branch of the Celtic. With them, no doubt, fled a number of the druidical priests, who unquestionably knew their native dialect in all its beauties and varieties. These fugitives in process of time formed a regular government, elected a king, and became a considerable state. They were sequestered by their situation from the rest of the world. Without commerce, without agriculture, without the mechanical arts, and without objects of ambition or emulation, they addicted themselves wholly to the pastoral life as their business, and to hunting and fishing as their diversion. Those people were not distinguished by an innovating genius; and consequently their language must have remained in the same state in which they received it from their ancestors. They received it genuine *Celtic*, and such they preserved it.

When the Scots became masters of the low country, and their kings and a great part of the nobility embraced the Saxon manners, and adopted the Saxon language, the genuine Caledonians tenaciously retained their native tongue, dress, manners, clanships, and feudal customs, and could never cordially assimilate with their southern neighbours. Their language, therefore, could not be polluted with words or idioms borrowed from a people whom they hated and despised. Indeed it is plain from the whole tenor of the Scottish history, that neither Caledonian chieftains, nor their vassals, were ever steadily attached to the royal family after they fixed their residence in the low country, and became *Saxons*, as the Highlanders called them by way of reproach. Indeed the commerce between them and those of the south, till about a century and a half ago, was only transient and accidental; nor was their native dialect in the least affected by it.

208 Causes of the purity of the Scotch dialect of this ancient language.

Their language, however, did not degenerate, because there existed among them a description of men whose profession obliged them to guard against that misfortune. Every chieftain retained in his family a bard or poet laureat, whose province it was to compose poems in honour of his lord, to commemorate the glorious exploits of his ancestors, to record the genealogy and connections of the family; in a word, to amuse and entertain the chief and his guests at all public entertainments and upon all solemn occasions. These professors of the Parnassian art used to vie with each other; and the chiefs of families often assembled their respective bards, and encouraged them by considerable premiums to exert their poetic talents. The victor was rewarded and honoured; and the chieftain deemed it an honour to himself to entertain a bard who excelled his peers. The ancient Gauls, as we learn from Diodorus Siculus, Strabo, Tacitus, Lucan, &c. entertained persons of that profession; and certainly the ancient Britons did the same. Those bards were highly revered; their persons were deemed sacred; and they were always rewarded with salaries in lands or cattle (see Section *Greek*). Those poetic geniuses must have watched over their vernacular dialect with the greatest care and anxiety; because in their compositions no word was to be lost, but as many gained as possible.

The use of letters was not known among the ancient *Celtæ;* their druidical clergy forbade the use of them. All their religious rites, their philosophical dogmas, their moral precepts, and their political maxims, were composed in verses which their pupils were obliged to commit to memory. Accordingly letters were unknown to the Caledonian Scots, till they learned them either from their southern neighbours or from the Romans. The Irish, indeed, pretend to have letters of a very ancient date; the Highlanders of the country in question make no claim to the use of that invention. Their bards, therefore, committed every thing to memory; and of course the words of their language must have been faithfully preserved. We find that the celebrated poems of Ossian, and others of an inferior character, or at least fragments of such poems (see OSSIAN), have thus been preserved from father to son for more than 1000 years. The beauty, significancy, harmony, variety, and energy of these verses, strike us even in a prose translation: how infinitely more charming must they appear in their native form and poetical attire!

In order to exhibit the genius of the Celtic in as striking a light as the nature of our present design will permit, we shall lay before our readers a very contracted sketch of the Gaelic or Caledonian dialect as it now stands; which we hope will go a great way to convince them that this is the genuine offspring of the other. In doing this we shall borrow many hints from a gentleman * whose learning seems to equal his zeal for his native language; which, in compliance with the modern practice, we shall for the future distinguish by the name of *Gaelic.*

The Gaelic is not derived from any other language as far as we know, being obviously reducible to its own roots. Its combinations are formed of simple words of a known signification; and those words are resolvable into the simplest combinations of vowels and consonants, and even into simple sounds. In such a language we may expect that some traces will be found of the ideas and notions of mankind living in a state of primeval simplicity; and if so, a monument is still preserved of the primitive manners of the Celtic race while as yet under the guidance of simple nature, without any artificial restraint or controul.

The sudden sensations of heat and cold, and bodily pain, are expressed by articulate sounds, which, however, are not used in this language to denote heat, cold, or bodily pain. A sudden sensation of heat is denoted by an articulate exclamation *hait;* of cold, by *id;* of bodily pain, by *oich.* All these sounds may be called *interjections,* being parts of speech which discover the mind to be seized with some passion. Few of the improved languages of Europe present so great a variety of sounds which instantaneously convey notice of a particular passion, bodily or mental feeling.

The pronouns *he* and *she* are expressed by the simple sounds *e* and *i*, and these are the marks of the masculine and feminine genders; for a neuter gender is unknown in the *Gaelic.* The compositions of rude and barbarous ages are universally found to approach to the style and numbers of poetry; and this too is a distinguishing character of the *Gaelic.* Bodily subsistence will always be the principal concern of an uncultivated people. Hence *ed* or *eid* is used upon discovery of any animal of prey or game: it is meant to give notice to the hunting companion to be in readiness to seize the animal: and hence we believe *edo* "to eat" in Latin, and *ed* in Irish, signifies "cattle;" likewise in Scotch *edal* "cattle," literally signifies "the offspring or generation of cattle." *Coed* or *cued,* "share or portion of any subject of property," literally "common food." *Faoed* "hunting," literally "gathering of food." *Edra* "the time of the morning when cattle are brought home from pasture to give milk," literally "meal-time." These are words importing the simplicity of a primitive state, and are common in the Gaelic idiom.

Traces of imitative language remain in all countries. The word used for *cow* in the Gaelic language is *bo,* plainly in imitation of the lowing of that animal.

209 Excellency of Gaelic compounds.

In joining together original roots in the progress of improving language and rendering it more copious, its combinations discover an admirable justness and precision of thought, which one would scarce expect to find in an uncultivated dialect. It will, however, be found, upon examination, that the Gaelic language, in its combination of words, specifies with accuracy the known qualities, and expresses with precision the nature and properties which were attributed to the object denominated.

An appears to have been a word of frequent use in this language, and seems to have been originally a name applied indefinitely to any object. According to Bullet, it was used to signify "a planet;" hence the *sun* had the name of *grian,* which is a compound of *gri* "hot," and *an* "a planet." *Re* signifies originally and radically "division." The changes of the moon and the variety of her phases were early employed to point out the divisions of time. The present name for the *moon* is *gealach:* a word derived from her whiteness of colour. To these we might add a vast number more whose signification precisely indicates their shape, colour, effects, &c. Many of these would be found exactly similar to

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* Essays, &c. by James Grant, Esq. advocate.

Greek and Latin words of the same sound and signification. In order to satisfy our curious readers, we shall annex a few, though some of them may perhaps be questionable.

The *Venus* of the Latins is said to be a compound of *ben* and *jus*, which literally signify the "first woman," the letter *b* in Gaelic being softened into *v*. Εδαρ and ειδαρ signify "food." These words are compounded of the Gaelic words *ed* or *eid* and *ar;* the former denotes *food* simply, and the latter *ploughed land*. These are the roots of the Greek and Latin words εδω, *edo;* αροω, *aro*. Εδρα, which signifies "a seat," has an evident reference to food. It is compounded of two Gaelic words *ed* and *ira*, which literally signifies "meal-time." Εδνα, which signifies "the presents which a bridegroom made to his bride," is a compound of two Gaelic words *ed* and *na* or *nuah*, literally signifying "raw food." From *ar* there are many Greek derivatives. Αρουρα signifies "ploughed land," also "crop of corn;" Αρτος, "bread." In Gaelic *a crop of corn* and *bread* are expressed by *arbhar*, commonly pronounced *arar* and *aran;* all being equally derivatives of the root *ar*. So the Greek and Latin words αροτος, *arabilis*, "arable;" αροτρον, *aratrum*, "a plough;" αροτης, *arator*, "a ploughman;" and many others, are evidently derived from the same source. We would not, however, suggest, in consequence of this coincidence, that either the Greek or Latin languages was derived from the Gaelic; we rather believe that these are remains of a primeval tongue, which are still retained in all the three; and we produce them upon the present occasion as presumptions that the Gaelic is an original, underived language, and of course the most pure and unadulterated relick of the Celtic now existing. If our readers should incline to know more of this subject, they may consult Pezron's *Origin of Ancient Nations*, Bullet's *Mem. de la Langue Celtique*, Parson's *Rem. of Japhet*, Gebelin's *Monde prim.* &c.

210
Copiousness and antiquity of the Celtic.

When the Celtic language was generally spoken over Europe, it seems to have been amazingly copious. By consulting Bullet's *Memoires*, it appears that its names for the common and various objects of nature were very numerous. The words denoting water, river, wood, forest, mountain, lake, &c. were most precisely accommodated to specify each modification and variety, with such peculiar exactness as even the Greek, with all its boasted idiomatical precision and copiousness, has not been able to equal. The appearances which diversify the visible face of animated nature, arrest the attention of men in an uncultivated state. Unaccustomed to thought and abstract reasoning, their minds expand and exercise their powers upon sensible objects, and of course mark every *minutia* and almost imperceptible distinction with an accuracy to us seemingly impossible.

We hope it now appears to every reader, that the Celtic was one of the dialects of the primitive language; that it once overspread by far the greatest part of Europe; that the Gaelic now spoken in the northern parts of Scotland and the adjacent islands is the most pure and unmixed relick of that tongue now anywhere existing. We would willingly refer our readers to some well composed grammar of that language; but indeed we know of none that deserves our recommendation. Some years ago we were flattered with the prospect of seeing one published by a gentleman whose deep skill in that language is universally acknowledged. We have likewise heard of an intended dictionary of the same tongue; but hitherto our hopes have been disappointed.

We are, however, happy to find that there is now publishing an excellent translation of both the Old and New Testaments into Gaelic, which has hitherto been a desideratum among those who speak this language. Such a translation will at once contribute to preserve that ancient tongue, and disseminate the knowledge of the truth among the natives of that country.

Every assistance towards acquiring the knowledge of a tongue which was once universal over a great part of Europe, will certainly be an acceptable present to the public. The antiquary, who is desirous of tracing the affinity of languages, and wishes to mark the migrations of people, ought certainly to apply himself to the study of its remaining branches; and, if we mistake not, he will soon be convinced, that they all breathe a spirit congenial to the manners and sentiments of a people who are just entering upon the first stage of improvement and civilization.

211
Origin of the words *Gaul* and *Gal*.

Perhaps it may be expected, that, before we conclude this short sketch of the Celtic tongue, we should give some account of the origin of the words *Gaul* and *Gal*, the two names by which this people was distinguished by the Greeks and Romans. Mr M'Pherson imagines, that the appellation of *Celt* is an adjective derived from *Gael*, the aboriginal name of the inhabitants of ancient Gaul. For our part, we can see no connection between *Gael* and *Kelt*, nor do we think that the latter is an adjective. We believe that those people called themselves *Cael* and not *Gael*. We are sure that *Caledonia*, or *Cal-don* or *dun*, was an ancient name of the mountainous parts of Scotland.

Though many different opinions have been advanced with relation to the etymology of this word, we imagine that none is so probable as that which supposes that it is compounded of the two Celtic words *Cal* or *Kal*, that is, "Gal or Gaul," and *dun*, which signifies "a hill or mountain." Upon this ground, the Caledonii will import the Gauls of the mountains, or which is the same, the Highland Gauls. The Irish and Highlanders reciprocally denominate themselves by the general title of *Cael*, *Gael*, or *Gauls*. They also distinguish themselves, as the Welsh originally did, and as the Welsh distinguish them both at present, by the appellation of *Guidhill*, *Guethel*, and *Gathel*. The intermediate *th*, they say, is left quiescent in the pronunciation, as it is in many words of the British language; in which case *Gathel* would immediately be formed into *Gael;* and Gathel is actually sounded like *Gael* by both the Irish and Highlanders at present. The appellation of *Gathel*, therefore, say they, was originally the same with *Gael*, and the parent of it. The quiescent letters in British are frequently transferred from the middle to the conclusion of the word; by which manœuvre, *Gathel* is changed into *Galath*, *Galat*, *Galt*, and *Celt*. It is true, that *Gael* of the continent is universally denominated *Galatæ* and *Celtæ* by the Grecians, and *Gallt* and *Gallta* by the Irish. The appellations, therefore, of *Gathel-i*, *Gall-i*, *Gallat-æ*, *Calet-es*, *An-calit-es*, and *Celt-æ*, are all one and the same denomination, only varied by the astonishing ductility of the *Celtic*, and disguised by the alterations ever incident to a language that has been merely oral for ages.

It may perhaps appear presumptuous in us to differ

fer from two such respectable authorities as M'Pherson and Whitaker: we must, however, acknowledge, that neither the one nor the other appears to us well founded. Besides, they convey no idea of the signification of the words, though in the Celtic language they must have been significant. The name *Cael*, the same with *Gal*, was probably giving them in the East from the Greek καλ, which in many oriental languages denotes *fair*; and γαλατια may be easily derived from γαλ or γαλαθ, *Gal* or *Galuth*.—This denomination might be given them by their neighbours, in allusion to their fair complexion.

§ 2. *Of the Gothic Language.*

212 Ancient Gothic.

THE Celtic and Gothic tongues at one time divided Europe between them. Both were of equal antiquity, both originated in Asia, both were dialects of the original language of mankind. The Celtic, however, was first imported into Europe. The Gauls or Celts had penetrated farthest towards the west; a circumstance which plainly intimates the priority of their arrival. In the population of countries, we believe it may be held as a maxim, that the colonies who emigrated first were generally impelled by succeeding emigrants; and that of consequence the most early were pushed forward to the parts most distant. The Celts, then, having overspread the most western parts of Europe, must have arrived more early in those regions.

* Lib. i. cap. 2.
† Lib. ii. cap. 23.
213 The same with the language of the Thracians.
‡ Lib. 7.

The Goths and Getæ were the same race of people, according to Procopius *, *de bello Goth.*; and Strabo † (B) informs us, that they spoke the same language with the Thracians, from whose confines they had spread themselves northward as far as the western banks of the Danube. Vopiscus, in the History of Probus tells us, that this emperor ‡ obliged "the Thracians, and all the Getic tribes, either to surrender or accept of his friendship." This expression indicates, that the Thracians and the Getic tribes were deemed the same race of people. From this deduction it is clear, that the Getæ and Thracians were brethren; that they spoke the same language: and that their laws, manners, customs, and religious tenets, were the same, might easily be shown, were this a proper place for an inquiry of that nature.

The Thracian language, as might be demonstrated from names of persons, offices, places, and customs, among that people, was nearly related to the Chaldean and other oriental languages.

214 Origin of the Goths.

They are thought to have been the descendants of Tiras, one of the sons of Japhet, and consequently must have preserved the speech of the Noachic family. The Gothic language abounds with *Pahlavi*, or old Persic words, which are no doubt remains of the primeval dialect of mankind. The Thracians peopled a considerable part of the northern coast of Asia Minor; and consequently we meet with many names of cities, mountains, rivers, &c. in those parts, exactly corresponding with many names in Europe, evidently imposed by our Gothic progenitors. Any person tolerably acquainted with the remains of the Gothic tongue, will be able to trace these with little difficulty.

* Lib. iv. *passim.*

We learn from Herodotus *, that Darius in his expedition against the wandering Scythians who lived on the other side of the Ister or Danube, in his progress subdued the Getæ; and in the same passage the historian informs us, that these people held the immortality of the human soul, and that they were the bravest and most just of all the Thracians. After this period, we find them mentioned by almost every Greek writer, even familiarly; for Geta, in the comedies of that nation, is a common name for a slave. The Getæ then occupied all that large tract of country which extended from the confines of Thrace to the banks of the Danube; were a brave and virtuous people; and spoke the same language with the Thracians, with whom they are often confounded both by Greek and Roman historians.

But the name of *Goths* is by no means so ancient. It was utterly unknown both to the ancient Greeks and Romans. The first time that the name *Goth* is mentioned is in the reign of the emperor Decius, about the year of Christ 250. About that time they burst out of Getia, and, rushing like a torrent into the empire, laid waste every thing with fire and sword. The name of their leader or king was *Cneva*. Decius, endeavouring to expel them from Thrace, was vanquished and slain.

† *History of Norway*, lib. i.

After this irruption, we find them frequently in the Latin authors under the name of *Getæ* or *Gothi*; though the Greeks generally denominate them *Scythæ*. Torfæus tells us, that *get* † and *got* are actually the same word, which anciently, according to him denoted a "soldier." *Got* in Icelandic signifies a "horse or horseman," and *gata* a "wanderer;" and this last was perhaps the import of the term *Geta*, they being originally an unsettled vagrant people. As nations generally assume to themselves some high auspicious denomination, we may believe the Goths did the same. We may therefore rest satisfied, that the Getæ assumed the Icelandic name above mentioned as their national one: or perhaps, notwithstanding their Greek denomination, they called themselves *Gots* or *Goths* from the beginning.

215 Their primary seat.

The orginal seat of the Goths was the country now called *Little Tartary*, into which they had extended themselves from the frontiers of Thrace. This country was called *Little Scythia* by the Greek writers; and it was the station whence those innumerable swarms advanced, which, in conjunction with the Alani and other barbarous tribes, at length overran and subverted the western empire. One part of the Gothic nation was allowed by Constantine to settle in Mœsia. Before the year 420 most of the Gothic nations who had settled within the limits of the Roman empire had been converted to the Christian faith; but,

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(B) Lib. vii. page 295, B.; ibid. page 305. G. (Casaubon). From this passage it appears, that the Greeks were of opinion that the Getæ were Thracians. *Plin. Nat. Hist.* lib. iv. cap. 11. mentions a tribe of the Getæ called *Gaudæ*.

but, unhappily, the greater part of the apostles by whom they had been proselyted, were Arians, which proved fatal to many of the orthodox Christians; for the Arian Goths persecuted them with unrelenting cruelty.

216 Remains of genuine Gothic.

About the year 367, Ulphilas bishop of the Mœsian Goths, translated the New Testament into the Gothic language. The remains of this translation furnish a genuine, and at the same time venerable, monument of the ancient Gothic dialect. Nor more is now extant of that valuable translation than the four Gospels, and another fragment containing part of the epistle to the Romans. The Gospels have been repeatedly published since the first edition by Junius 1665, down to that of Mr Lye. Other fragments of the Gothic language have also been found, which our curious readers may see in Lye's Notes to his Edition of the Gothic Gospels. The fragment of the Epistle to the Romans was lately discovered in the library at Wolfenbuttle, and published by Knitel archdeacon of Wolfenbuttle.

The Goths, prior to the age of Ulphilas, were ignorant of the use of alphabetical characters. The bishop fabricated an alphabet for them, which is a medley of Greek and Roman letters, but rather inclining to the former.

217 Gothic alphabet.

This alphabet consists of 25 letters (see Plate XV.). Junius has carefully analyzed those letters, and pointed out their powers and sounds in his Gothic alphabet, prefixed to his *Glossarium Gothicum*. They were long retained in all the European languages derived from the Gothic source, which will be enumerated in the sequel.

What kind of language the ancient Gothic was, is plain from the fragments above mentioned; but in what respects it agrees with the oriental tongues, or differs from them, is not easy to ascertain with precision. We have observed in our section on the Greek, that a considerable part of that language must have been derived from the Thracian; which, according to Strabo there quoted, was the same with the Getic or Gothic. The Thracian tongue will, we are convinced upon comparison, be found analogous to the Chaldean or Syrian. The German, which is a genuine descendant of the Gothic, is full of Persian words: the old Persian or Pahlavi appears to be a dialect of the Chaldean. The learned Junius, near the beginning of his Gothic alphabet, remarks that a very considerable part of the language in question is borrowed from the most ancient Greek.

218 Gothic language derived from the Chaldean, &c.

Both the learned Ihre in his *Glossarium Suio-Gothicum*, and Wachter in his excellent German and Latin Dictionary, often remark the coincidence of Gothic and German words with oriental vocables of the like sound and of the same signification. In the old Saxon, which is another ramification of the Gothic tongue, numberless terms of the very same complexion appear. From this deduction we hope it will follow, that the Gothic tongue, in its original unmixed state as it was spoken by the ancient Getæ, was a dialect of the primeval language; that language which the sons of Tiras brought with them from the plains of Shinar or from Armenia, or from any other region, where the primitive mortals had fixed their residence. To confirm this position, we shall annex a few instances.

The Thracian tribes, in all probability, first took possession of those tribes of Asia Minor which stretch towards the east. Thence they crossed the Hellespont, and spread themselves far and wide northward. Strabo supposes that they first settled in the regions to the north of those straits, and thence transported numerous colonies into Asia Minor. The reverse was probably the case; but be that as it may, it is universally agreed, that both sides of the Hellespont were peopled with Thracians.

In Asia Minor we meet with the city Perga, which, throwing away the *a*, is *Perg*. In every tongue descended from the Gothic, the word *Berg* signifies "a rock," and metaphorically a "town or burgh;" because towns were originally built on rocks for the sake of defence. Hence likewise *Pergamos*, the fort or citadel of Troy. *Beira* in Thracian signified a "city;" the Chaldaic and Hebrew word *Beer* imports a "well," and is possibly the original of the Gothic word *beer*, *ale*. In ancient times, especially in the East, it was customary to build cities in the neighbourhood of fountains. The ancients called the Phrygians Βρυγες, *Bryges*, or *Bruges*; the Gothic word coinciding is obvious. *Dyndymus*, the name of a city sacred to Cybele, is compounded of two Gothic words *dun* and *dum*, both signifying "a height, an eminence;" and hence *a town*, *an inclosure*. The word *tros* seems to be the very Gothic *trosh*, "brave, valiant." The words *fader*, *mader*, *dochter*, *bruder*, are so obviously Persian, that every etymologist has assigned them to that language.

Many futile etymologies have been given of the sacred name *God*, which is in reality the Persian word *Choda*, commonly applied by them to their *Hormuzd* or *Oromazes*. The Persian *bad* or *bod* signifies a "city;" the same word in Gothic imports a "house, a mansion, an abode." *Band*, in Persic, a "strait place;" in Gothic, "to bend." *Heim* or *ham*, "a house," is generally known to be of Persian original. Much critical skill has been displayed in tracing the etymology of the Scotch and old English word *Yule*, "Christmas." *Yule*, derived from *iul*, was a festival in honour of the sun, which was originally celebrated at the winter solstice. *Wick* or *wich* is a Gothic term still preserved in many names of towns; it signifies "a narrow corner, or small strip of land jutting into the sea, or into a lake or river:" hence the Latin *vicus*, and Greek φοικος. In Spanish, we have many old Gothic words; among others *hijo* a "son," the same with the Greek υιος. In some places of Scotland, we call any thing that is little, small, *wee*; originally spelt *wi*, if we mistake not, from the very same word.

These few examples we have thrown together, without any regard to order, persuaded that almost every word of the language, truly Gothic, may with a little pains and judgment be traced to some oriental root or cognate. We may observe in passing, that many Gothic nouns end in *a*, like the Chaldaic and Syriac; that their substantive verb very much resembles that of the Persian, Greek, and Latin; and that their active and auxiliary verb has furnished the common preterperfect tense of Greek verbs in the active voice: that verb is *haban*, but originally *ha*, as the common people pronounce it at this day, especially in the north of Scotland, and among the Swedes, Danes, Norwegians, and Icelanders.

219 Modern tongues deduced from the Gothic.

We shall now leave the other inferior arrangements of this ancient language to grammarians and lexicographers, and proceed to inquire what modern tongues are deduced from it as their stock, and which of them makes the nearest approaches to its simplicity and rusticity.

We have already observed that the Goths, formerly Getæ, were possessed of a vast extent of country, reaching from the frontiers of Thrace to the banks of the Ister or Danube. We have seen that a colony of them settled in Mœsia under Constantine II. They then spread themselves into Dacia, and from thence into Germany. All these countries were situated in such a manner, that the progress of population was forward, and according to the natural course of emigration. From Germany they extended themselves into Scandinavia, that is, Sweden, Denmark, and Norway. Their whole ancient *Edda*, *Sagas*, "Chronicles," show that the Goths arrived in Scandinavia by this route, without, however fixing the era of that event with any tolerable degree of accuracy. By the Germans, we believe the ancients understood all the nations eastward, westward, and northward, reaching from the Danube on the south up to the extremity of Scandinavia on the Northern ocean; and from the Rhine and German ocean on the west, to the river Chronus or Niemen on the east. All those nations spoke one or other of the Gothic dialects, some approaching nearer, and others deviating farther from, the parent language.

The Francic is a dialect of the Teutonic, *Tudesque*, or old German; and the Gospels of Ulphilas bear such a resemblance to the Francic, fragments of which are preserved in the early French historians, that some learned men have pronounced those gospels to be part of an old Francic version; but others of equal respectability have refuted this opinion, both from history and comparison of the dialects. Schilter has given us large monuments of the Tudesque or old German from the seventh century, which evidently prove that the Gothic of Ulphilas is the same language. Wachter's learned Glossary of the ancient German likewise confirms this position. Mr Ihre, after hesitating whether the Gospels of Ulphilas bear most resemblance to the German or Scandinavian dialect of the Gothic, declares at last in favour of the former. The Anglo-Saxon is also known to be a venerable dialect of the Tudesque; and is so intimately connected with the gospels, that some valuable works on this subject are wholly built upon that supposition.

The Icelandic is the oldest relick of the Scandinavian. It begins with Arius Frode in the eleventh century, and is a dialect of the German. The remains we have of it are more modern by four centuries than those of the German: they are more polished than the other. The words are shortened, not only because they are more modern than the German, but because the Icelandic was polished by a long succession of poets and historians almost equal to those of Greece and Rome. Hence the Icelandic, being a more polished language than the German, has less affinity with the parent Gothic. The Swedish is more nearly related to the Icelandic than either the Danish or Norwegian. That the Swedish is the daughter of the Gothic, is fully shown by Mr Ihre above mentioned, in his *Glossarium Suio-Gothicum*. There is, therefore, no manner of doubt as to the identity of the Gothic, preserved in Ulphilas and other ancient remains, with the German and Scandinavian tongue.

The modern German, a language spoken in a far greater extent than any other of modern Europe, resembles the Gothic Gospels more than the present Danish, Norwegian, or Swedish; and has certainly more ancient *stamina*. Its likeness to the Asiatic tongues, in harshness and inflexible thickness of sound, is very apparent.

Busbequius shows, that the clowns of Crim Tartary, remains of the ancient Goths, speak a language almost German. These clowns were no doubt descendants of the ancient Goths, who remained in their native country after the others had emigrated. It is therefore apparent from the whole of this investigation, that the Gothic was introduced into Europe from the East, and is probably a dialect of the language originally spoken by men.

§ 3. *Of the Sclavonian Language.*

220 Sclavonic language,

There is another language which pervades a considerable part of Europe, and this, like the Gothic, seems to have originated in the east. The language we mean is the Sclavonic or rather Slavonic, which prevails far and wide in the eastern parts of this division of the globe. It is spoken by the Dalmatians, by the inhabitants of the Danubian provinces, by the Poles, Bohemians, and Russians. The word *slab*, that is, "slave," (whence the French word *esclave*, and our word *slave*), signifies "noble, illustrious;" but because in the lower ages of the Roman empire, vast multitudes of these people were spread over all Europe in the quality of slaves, that word came to denote the servile tribe by way of distinction, in the same manner as the words *Geta*, *Davus*, and *Syrus*, did among the Greeks at a more early period.

221 spoken by the Slavi one of the tribes of the Sarmatians.

The Slavi dwelt originally on the banks of the Borysthenes, now the Dnieper or Nieper. They were one of the tribes of the European Sarmatians who in ancient times inhabited an immense tract of country, bounded on the west by the Vistula, now the Weisel; on the south-east by the Euxine sea, the Bosphorus Cimmerius, the Palus Mœotis, and the Tanais or Don, which divides Europe from Asia.

In this vast tract of country, which at present comprehends Poland, Russia, and a great part of Tartary, there dwelt in ancient times many considerable tribes. To enumerate these, we believe, would not much edify our readers: we shall only inform them, that among these Sarmatian clans were the Roxolani, now the Russians, and likewise the Slavi, who dwelt near the Borysthenes, as was observed above.

The Slavi gradually advanced towards the Danube; and in the reign of Justinian having passed that river, they made themselves masters of that part of Illyricum which lies between the Drave and the Save, and is to this day from them called *Sclavonia*. These barbarians by degrees overran Dalmatia, Liburnia, the western parts of Macedonia, Epirus; and on the east they extended their quarters all along to the western bank of the Danube, where that river falls into the Euxine. In all these countries, the Sclavonian was deeply impregnated with the Greek, which was a thing of course, since the barbarian invaders settled in those regions, and mingled with the aborigines, who spoke a corrupt dialect of that language.

222 the Poles,

The Poles are the genuine descendants of the ancient Sarmatæ (c), and consequently speak a dialect of their language, but much adulterated with Latin words, in consequence of the attachment the Polanders have long professed to the Roman tongue.

223 Silesians, and

The Silesians and Bohemians have corrupted their dialects in the very same manner. In those countries, then, we are not to search for the genuine remains of the ancient Sarmatian.

224 Russians descended from the Slavi.

The modern Russians, formerly the Rhoxani or Roxolani, are the posterity of the Sarmatæ, and are a branch of the Slavi: they inhabit a part of the country which that people possessed before they fell into the Roman provinces; they speak the same language, and wear the very same dress; for, on the historical pillar at Constantinople, the Sclavonians are dressed like the Russian boors. If then the Slavi are Sarmatæ, the Russians must of course be the descendants of the same people. They were long a sequestered people, and consequently altogether unconnected with the other nations of Europe. They were strangers to commerce, inhospitable to strangers, tenacious of ancient usages, averse to improvements of every kind, wonderfully proud of their imaginary importance; and, in a word, a race of people just one degree above absolute savagism. A people of this character are, for the most part, enemies to innovations; and if we may believe the Russian historians, no nation was ever more averse to innovations than the one in question. From the ninth century, at which era they embraced Christianity, it does not appear that they moved one step forward towards civilization, till Peter the Great, not a century ago, in consequence of his despotic authority, compelled them to adopt the manners and customs of their more polished neighbours.

We may then conclude, that the Russians made as little change in their language during that period, as they did in their dress, habits, and manner of living. Whatever language they spoke in the ninth century, the same they employed at the beginning of the 18th. They were, indeed, according to *Appian de bel. Mithrid.* once conquered by Diophantus, one of Mithridates's generals, but that conquest was for a moment only: they were likewise invaded, and their country overrun, by the great Timor or Tamerlane; but this invasion was like a torrent from the mountains, which spreads devastation far and wide while it rages, but makes little alteration on the face of the country.

We find likewise, that upon some occasions they made incursions upon the frontiers of the Roman empire; but we hear of no permanent settlements formed by them in these quarters. Upon the whole, we take the Russians to have been, with respect to their language, in the very same predicament with the highlanders and islanders of Scotland, who, according to the general opinion, have preserved the Celtic dialect pure and entire, in consequence of their having never mingled with foreigners.

225 The Russian language genuine Sclavonic.

From this deduction we may infer two things; first, that the Russian language is the genuine Sclavonian; and, secondly, that the latter is the same, or nearly the same, with the ancient Sarmatian.

In the Russian, there are found a great number of words resembling the old simple roots of the Greek both in sound and signification; its grammatical genius is nearly the same; and we are informed by the very best authority, that there is in this language a translation of Epictetus, in which there are whole pages, in both original and translation, without one single transposition. Mons. Leveque, who has published a translation of a history of Russia, is so entirely convinced of the strict analogy between the ancient Greek and the modern Russe, that he is positive that the former is derived from the latter. Mons. Freret, a very learned French academician, is clearly of the same opinion. We are, however, persuaded that this opinion is ill founded. We rather imagine, that those coincidences arise from the relicks of the primitive language of mankind; vestiges of which, we believe, are to be found almost in every tongue now existing.

It is, however, we allow, uncommonly difficult to render a reason for the syntaxical analogy of the two languages, without admitting the truth of the one or the other hypothesis. We have examined with some care a good number of Russian vocables, and compared them with Greek ones of the same signification. We have not, however, found such a resemblance as we think necessary to support the position advanced above.

226 Resemblance between Russian and oriental words.

We have indeed found a very strong resemblance between the former and many oriental words, especially Hebrew, Chaldean, and old Persian, of which we could produce several instances, did the nature of our present inquiry admit such a deviation. Every body knows that the Sarmatæ were divided into two great nations, the Asiatic and European; the former extended very far eastward, behind the mountain Caucasus, the northern shore of the Euxine sea, and so forth. These, we may believe, derived their language from the original tongue long before the Greek language existed. This, in comparison of the Hebrew, Phœnician, Egyptian, Arabian, Chaldean, &c. was but of yesterday. The Greek, most learned men are now convinced, was a late composition of many different dialects, incorporated with the jargon of the aboriginal Ionim or Greeks. The Sarmatian, on the contrary, was the tongue of a great and populous nation, civilized, in all appearance, long before the Greeks began to emerge from a state of savagism. We are, therefore, by no means disposed to allow, either that the Greek is derived from the Russian, or the Russian from the Greek. We believe there is just the same reason for this conclusion, that the Abbé Pezron and Mons. Gebelin pretend to have discovered, in order to support their position that the Greek is derived from the Celtic. Certain it is, that the resemblance among the oriental languages, of which we take the Sarmatian to have been one, is so palpable, that any person of a moderate capacity who is perfectly master of one, will find little difficulty in acquiring any other. If, therefore, the coincidence between the Greek and Russian should actually exist, we think this circumstance will not authenticate the supposition, that either of the two is derived from the other.

(c) This appears by their character, their laws, their manners, their form of government, their military equipage, their impetuosity, their aristocratic splendour.

In the course of this argument, our readers will be pleased to observe, that we all along suppose, that the Sclavonian, of which we think the Russian is the most genuine remain, is the same with the old Sarmatian. We shall now take the liberty to hazard a conjecture with respect to the syntaxical coincidence of that language with the Greek; for we acknowledge that we are not so profoundly versed in the Russian dialect of the Sclavonian as to pretend to pronounce a definitive sentence.

227 Origin of the syntaxical coincidence between this language and the Greek.

As the Russians were a generation of savages, there is no probability that they were acquainted with the use of letters and alphabetical writing till they acquired that art by intercourse with their neighbours. It is certain, beyond all contradiction, that few nations had made less proficiency in the fine arts than that under consideration: and we think there is little appearance of their having learned this art prior to their conversion to Christianity. Certain it is, that the Slavi, who settled in Dalmatia, Illyria, and Liburnia, had no alphabetical characters till they were furnished with them by St Jerome. The Servian character, which very nearly resembles the Greek, was invented by St Cyril; on which account the language written in that character is denominated *Chiurilizza*. These Sclavonic tribes knew nothing of alphabetic writing prior to the era of their conversion. The Mœsian Goths were in the same condition till their bishop Ulphilas fabricated them a set of letters.

If the Slavi and Goths, who resided in the neighbourhood of the Greeks and Romans, had not learned alphabetical writing prior to the era of their conversion to Christianity, it must hold, *à fortiori*, that the Russians, who lived at a very great distance from those nations, knew nothing of this useful art antecedent to the period of their embracing the Christian faith.

The Russians pretend that they were converted by St Andrew; but this is known to be a fable. Christianity was first introduced among them in the reign of the grand duke Wolodimar, who marrying the daughter of the Grecian emperor Basilius, became her convert about the year 989. About this period, we imagine, they were taught the knowledge of letters by the Grecian missionaries, who were employed in teaching them the elements of the Christian doctrines. Their alphabet consists of 31 letters, with a few obsolete additional ones; and these characters resemble those of the Greeks so exactly, that there can be no doubt of their being copied from them. It is true, the shape of some has been somewhat altered, and a few barbarian ones have been intermingled. The Russian liturgy, every body knows, was copied from that of the Greeks; and the best specimen of the old Russian is the church offices for Easter, in the very words of Chrysostom, who is called by his name *Zlato ustii*, "golden-mouthed." The power of the clergy in Russia was excessive; and no doubt their influence was proportioned to their power. The first race of clergy in that country were undoubtedly Greeks. We know how active and industrious those people were in propagating their language as well as their religion. The offices of religion might be at first written and pronounced in the Greek tongue, but it would soon be found expedient to have them translated into Russian. The persons employed in this work must have been Greeks, who understood both languages.

As it is confessedly impossible that a people so dull and unattentive as the Russians originally were, could ever have fabricated a language so artificially constructed as their present dialect; and as it is obvious, that, till Christianity was introduced among them by the Greeks, they could have no correspondence with that people—it must appear surprising by what means their language came to be fashioned so exactly according to the Greek model. We have observed above, that the Russian letters must have been invented and introduced into that country by the Greek missionaries. We think it probable, that those apostles, at the same time that they taught them a new religion, likewise introduced a change into the idiom of their language. The influence of those ghostly teachers over a nation of savages must have been almost boundless; the force of their precepts and example almost incontrollable. If the savage converts accepted a new religion from the hands of those Grecian apostles, they might with equal submission adopt improvements in their language. Such of the natives as were admitted to the sacerdotal function must have learned the Greek language, in order to qualify them for performing the offices of their religion. A predilection for that language would be the immediate consequence. Hence the natives, who had been admitted into holy orders, would co-operate with their Grecian masters in improving the dialect of the country; which, prior to the period above mentioned, must have greatly deviated from the original standard of the Sarmatian tongue.

Upon this occasion, we imagine the Greek apostles, in conjunction with their Russian disciples, reduced the language of the country to a resemblance with the Greek idiom. They retained the radical vocables as they found them; but by a variety of flections, conjugations, derivations, compositions, and other modifications, transformed them into the Grecian air and apparel. They must have begun with the offices of the church; and among a nation of savages newly converted, the language of the new religion would quickly obtain a very extensive circulation. When the Grecian garniture was introduced into the church, the laity would in process of time assume a similar dress. The fabric of the Grecian declensions, conjugations, &c. might be grafted upon Russian stocks without affecting the radical parts of the language. If the dialect in question, like most others of a very ancient date, laboured under a penury of vocables, this manœuvre would contribute exceedingly to supply that defect. By this expedient the Greek language itself had been enlarged from about 300 radical terms to the prodigious number of words of which it now consists.

The Latin tongue we have seen above in its original constitution differed widely from the Greek; and notwithstanding this incongruity, the improvers of the former have pressed it into a very strict agreement with the latter. This, we think, was still a more difficult task; as, in our opinion, the genius of the Latin differs in a much greater degree than that of the Russian does from the Greek. We know, that the genius of the Gothic tongue and those of all its descendants are much more in unison with the Greek than with that of the Latin. The Spanish, Italian, and French, have cudgelled many of their Gothic, Teutonic, and Celtic verbs, into a kind of conjugations, imitating or rather aping those of the Latin. The Persians have formed most elegant and energetic declensions and conjugations, upon inflexible roots borrowed from the Pahlavi and Deri, and even from Tartar originals.

Upon the grounds above mentioned we have taken the liberty to hazard the following conjectures, which we cheerfully submit to the cognizance of our more enlightened readers.

1. That the Sarmatian was a dialect of the original language of mankind.

2. That the Sclavonian was a dialect of the Sarmatian.

3. That the Russe is the most genuine unsophisticated relick of the Sclavonian and Sarmatian.

4. That the Russians had no alphabetic characters prior to the era of the introduction of Christianity, that is, towards the end of the tenth century.

5. That they were converted by Grecian missionaries.

6. That those missionaries copied their present letters from those of Greece; and in conjunction with the more enlightened natives, reduced the original unimproved Russe to its present resemblance to the Greek standard.

228 Russian nouns. The Russian language, like most others, contains eight parts of speech, noun, pronoun, &c. Its nouns have three genders, masculine, feminine, and neuter; it has also a common gender for nouns, intimating both sexes. It has only two numbers, singular and plural. Its cases are seven, nominative, genitive, dative, accusative, vocative, instrumental, and prepositive. These cases are not formed by varying the termination, as in Greek and Latin; but generally by placing a vowel after the word, as, we imagine, was the original practice of the Greeks (See *Greek* Section). Thus in Russe, ϱυκ, *ruk*, "the hand;" nominative, ϱυκ-α, "the hand;" genitive, ϱυκ-N` "of the hand," &c. See *Les Elem. de la Langue Russe par Charpentier*.

219 Adjectives. Nouns substantive are reduced to four declensions, and adjectives make a fifth. These agree with their substantives in case, gender, and number. They have three degrees of comparison, as is common in other languages; the positive, comparative, and superlative. The comparative is formed from the feminine of the nominative singular of the positive, by changing *a* into *te*, that is, *aie* in English; the superlative is made by prefixing ϖϱε, *pre*, before the positive. These rules are general; for the exceptions, recourse must be had to the Russian grammar above mentioned.

The numeral adjectives in Russe have three genders like the rest, and are declined accordingly. Their pronouns have nothing peculiar, and are divided and arranged in the same manner as in other languages.

230 Verbs. Verbs in the Russian language are comprehended under two conjugations. The moods are only three; the indicative, the imperative, and the infinitive: the subjunctive is formed by placing a particle before the indicative. Its tenses are eight in number; the present, the imperfect, the preterite simple, the preterite compound, the pluperfect, the future indeterminate, the future simple, the future compound. The verbs have their numbers and persons as in other languages. To enter into a detail of their manner of conjugating their verbs would neither be consistent with our plan, nor, we are persuaded, of much consequence to our readers. Their other parts of speech differ nothing from those of other languages. Their syntax nearly resembles that of the Greek and Latin. All these articles must be learned from a grammar of the language. Whether there is any grammar of the Russian language composed in English we know not. That of Mons. Charpentier in French, printed at Petersburgh in 1768, is the only one we have seen, and which appears to us a very excellent one. We could wish to be able to gratify our readers with a more authentic account of the origin of the Sclavonian language; but this we find impossible, in consequence of the want of memorials relating to the state of the ancient Sarmatæ. Towards the era of the subversion of the western empire, the nations who inhabited the countries in question were so blended and confounded with each other, and with Huns and other Scythian or Tartar emigrants, that we believe the most acute antiquarian would find it impossible to investigate their respective tongues, or even their original residence or extraction. We have selected the Russe as the most genuine branch of the old Sclavonian, and to this predilection we were determined by the reasons above mentioned. We are sorry that we are not so well acquainted with the idiom of the Russian language as to be able to compare it with those of the east; but upon such a comparison, we are persuaded that the radical materials of which it is composed would be found to have originated in the oriental regions.

231 Phœnician and Chaldean words in Russe. The word *Tsar*, for example, is probably the Phœnician and Chaldean *Sar*, or *Zar*, "a prince, a grandee." Diodorus Siculus calls the queen of the Massagetæ, who, according to Ctesias, cut off Cyrus's head, *Zarina;* which was not many years ago the general title of the empress of all the Russias. Herodotus calls the same princess *Tomyris*, which is the very name of the famous Timor or Tamur, the conqueror of Asia. The former seems to have been the title, and the latter the proper name, of the queen of the Massagetæ. In the old Persian or Pahlavi, the word *Gard* signifies "a city;" in Russian, *Gorad* or *Grad* intimates the very same idea: hence *Constantinople* in old Russe is called *Tsargrad* or *Tsargorad*. These are adduced as a specimen only; and able etymologists might, we believe, discover a great number.

The Sclavonian language is spoken in Epirus, the western part of Macedonia, in Bosnia, Servia, Bulgaria, in part of Thrace, in Dalmatia, Croatia, in Poland, Bohemia, Russia, and Mingrelia, in Asia, whence it is frequently used in the seraglio at Constantinople. Many of the great men of Turkey understand it, and frequently use it; and most of the janizaries having been stationed in garrisons on the Turkish frontiers in Europe, use it as their vulgar tongue. The Hungarians, however, and the natives of Wallachia, speak a different language: and this language bears evident signatures of the Tartarian dialect, which was the tongue of the original Huns. Upon the whole, the Sclavonian is by much the most extensive language in Europe, and extends far into Asia.

Sect. X. *Modern Languages.*

If we call all the different dialects of the various nations that now inhabit the known earth, languages, the number is truly great; and vain would be his ambition who should attempt to learn them, though but imperfectly. We will begin with naming the principal of them: There are four, which may be called original or mother-languages, and which seem to have given birth to all that are now spoken in Europe. These are the *Latin*, *Celtic*, *Gothic*, and *Sclavonian*. It will not, however, be imagined, from the term *original* given to these languages, that we believe them to have come down to us, without any alteration, from the confusion of tongues at the building of the tower of Babel. We have repeatedly declared our opinion, that there is but one truly original language, from which all others are derivatives variously modified. The four languages just mentioned are original only as being the immediate parents of those which are now spoken in Europe.

232 Parent dialects of Europe, with their respective offspring.

I. From the *Latin* came,

1. The Portuguese.
2. Spanish.
3. French.
4. Italian.

From the *Celtic*,

5. The Erse, or Gaelic of the Highlands of Scotland.
6. The Welsh.
7. The Irish.
8. Basse Bretagne.

From the *Gothic*,

9. The German.
10. The Low Saxon or Low German.
11. The Dutch.
12. The English; in which almost all the noun-substantives are German, and many of the verbs French, Latin, &c. and which is enriched with the spoils of all other languages.
13. The Danish.
14. The Norwegian.
15. Swedish.
16. Icelandic.

From the *Sclavonian*,

17. The Polonese.
18. The Lithuanian.
19. Bohemian.
20. Transylvanian.
21. Moravian.
22. The modern Vandalian, as it is still spoken in Lusatia, Prussian Vandalia, &c.
23. The Croatian.
24. The Russian or Muscovite; which, as we have seen, is the purest dialect of this language.
25. The language of the Calmucs and Cossacs.
26. Thirty-two different dialects of nations who inhabit the north-eastern parts of Europe and Asia, and who are descended from the Tartars and Huno-Scythians. There are polyglott tables which contain not only the alphabets, but also the principal distinct characters of all these languages.

II. The languages at present generally spoken in Asia are,

233 Asiatic languages.

27. The Turkish and Tartarian, with their different dialects.
28. The Persian.
29. The Georgian or Iberian.
30. The Albanian or Circassian.
31. The Armenian.

These languages are spoken by the Greek Christians in Asia under the patriarch of Constantinople.

32. The modern Indian.
33. The Formosan.
34. The Indostanic.
35. The Malabarian.
36. The Warugian.
37. The Tamulic or Damulic.

The Danish missionaries who go to Tranquebar, print books at Hall in these languages.

38. The modern Arabic.
39. The Tangusian.
40. The Mungalic.
41. The language of the Nigarian or Akar Nigarian.
42. The Grusinic or Grusinian.
43. The Chinese.
44. The Japanese.

We have enumerated here those Asiatic languages only of which we have some knowledge in Europe, and even alphabets, grammars, or other books than can give us information concerning them. There are doubtless other tongues and dialects in those vast regions and adjacent islands; but of these we are not able to give any account.

234 African languages.

III. The principal languages of Africa are,

45. The modern Egyptian.
46. The Fetuitic, or the language of the kingdom of Fetu.
47. The Moroccan; and,
48. The jargons of those savage nations who inhabit the desert and burning regions. The people on the coast of Barbary speak a corrupt dialect of the Arabic. To these may be added the Chilhic language, otherwise called *Tamazeght*; The Negritian, and that of Guinea; the Abyssinian; and the language of the Hottentots.

235 American languages.

IV. The languages of the American nations are but little known in Europe. Every one of these, though distant but a few days journey from each other, have their particular language or rather jargon. The languages of the Mexicans and Peruvians seem to be the most regular and polished. There is also one called *Poconchi* or *Pocomana*, that is used in the bay of Honduras and towards Guatimal, the words and rules of which are most known to us. The languages of North America are in general the Algonhic, Apalachian, Mohegic, Savanahamic, Virginic, and Mexican: and in South America, the Peruvian, Caribic, the language of Chili, the Cairic, the Tucumanian, and the languages used in Paraguay, Brasil, and Guiana.

236 General reflections on modern languages.

V. We have already said, that it would be a vain and senseless undertaking for a man of letters to attempt the study of all these languages, and to make his head an universal dictionary; but it would be still more absurd in us to attempt the analysis of them in this place: some general reflections therefore must here suffice. Among the modern languages of Europe, the French seems to merit great attention; as it is elegant and pleasing in itself; as it is become so general, that with it we may travel from one end of Europe to the other without scarce having any occasion for an interpreter; and as in it are to be found excellent works of every kind, both in verse and prose, useful and agreeable. There are, besides, grammars, and dictionaries of this language which give us every information concerning it, and very able masters who teach it; especially such as come from those parts of France where it is spoken correctly; for with all its advantages, the French language has this inconvenience, that it is pronounced scarce anywhere purely but at Paris and on the banks of the Loire. The language of the court, of the great world, and of men of letters, is moreover very different from that of the common people; and the French tongue, in general, is subject to great alteration and novelty. What pity it is, that the style of the great Corneille, and that of Moliere, should already begin to be obsolete, and that it will be but a little time before the inimitable *chefs d'œuvres* of those men of sublime genius will be no longer seen on the stage: The most modern style of the French, moreover, does not seem to be the best. We are inclined to think, that too much conciseness, the epigrammatic point, the antithesis, the paradox, the sententious expressions, &c. diminish its force; and that, by becoming more polished and refined, it loses much of its energy.

VI. The German and Italian languges merit likewise a particular application; as does the English, perhaps above all, for its many and great excellencies (See LANGUAGE). Authors of great ability daily labour in improving them; and what language would not become excellent, were men of exalted talents to make constant use of it in their works! If we had in Iroquois books like those which we have in English, Italian, French, and German, should we not be tempted to learn that language? How glad should we be to understand the Spanish tongue, though it were only to read the Araucana of Don Alonzo D'Ercilia, Don Quixote, some dramatic pieces, and a small number of other Spanish works, in the original; or the poem of Camoens in Portuguese.

VII. The other languages of Europe have each their beauties and excellencies. But the greatest difficulty in all living languages constantly consists in the pronunciation, which it is scarce possible for any one to attain unless he be born or educated in the country where it is spoken: and this is the only article for which a master is necessary, as it cannot be learned but by teaching or by conversation: all the rest may be acquired by a good grammar and other books. In all languages whatever, the poetic style is more difficult than the prosaic: in every language we should endeavour to enrich our memories with great store of words (*copia verborum*), and to have them ready to produce on all occasions: in all languages it is difficult to extend our knowledge so far as to be able to form a critical judgment of them. All living languages are pronounced rapidly, and without dwelling on the long syllables (which the grammarians call *moram*): almost all of them have articles which distinguish the genders.

VIII. Those languages that are derived from the Latin have this further advantage, that they adopt without restraint, and without offending the ear, Latin and Greek words and expressions, and which by the aid of a new termination appear to be natives of the language. This privilege is forbidden the Germans, who in their best translations dare not use any foreign word, unless it be some technical terms in case of great necessity.

PHILOMATHES, a lover of learning or science.

PHILOMELA, in fabulous history, was a daughter of Pandion king of Athens, and sister to Procne, who had married Tereus king of Thrace. Procne separated from Philomela, to whom she was much attached, spent her time in great melancholy till she prevailed upon her husband to go to Athens and bring her sister to Thrace. Tereus obeyed; but he had no sooner obtained Pandion's permission to conduct Philomela to Thrace, than he fell in love with her, and resolved to gratify his passion. He dismissed the guards whom the suspicions of Pandion had appointed to watch him; offered violence to Philomela; and afterwards cut out her tongue, that she might not discover his barbarity, and the indignities she had suffered. He confined her in a lonely castle; and having taken every precaution to prevent a discovery, he returned to Thrace, and told Procne that Philomela had died by the way, and that he had paid the last offices to her remains. At this sad intelligence Procne put on mourning for the loss of Philomela; but a year had scarcely elapsed before she was secretly informed that her sister was not dead. Philomela, in her captivity, described on a piece of tapestry her misfortunes and the brutality of Tereus, and privately conveyed it to Procne. She was going to celebrate the orgies of Bacchus when she received it, but she disguised her resentment; and as during those festivals she was permitted to rove about the country, she hastened to deliver her sister Philomela from her confinement, and concerted with her on the best measures of punishing the cruelty of Tereus. She murdered her son Itylus, then in the sixth year of his age, and served him up as food before her husband during the festival. Tereus, in the midst of his repast, called for Itylus; but Procne immediately informed him that he was then feasting on his flesh, when Philomela, by throwing on the table the head of Itylus, convinced the monarch of the cruelty of the scene. He drew his sword to punish Procne and Philomela; but as he was going to stab them to the heart, he was changed into a hoopoe, Philomela into a nightingale, Procne into a swallow, and Itylus into a pheasant. This tragedy happened at Daulis in Phocis; but Pausanias and Strabo, who mention the whole of the story, are silent about the transformation; and the former observes, that Tereus, after this bloody repast, fled to Megara, where he laid violent hands on himself. The inhabitants of the place raised a monument to his memory, where they offered yearly sacrifices, and placed small pebbles instead of barley. It was on this monument that the birds called hoopoes were first seen; hence the fable of his metamorphosis. Procne and Philomela died through excessive grief and melancholy; and as the nightingale's and the swallow's voice is peculiarly plaintive and mournful, the poets have embellished the fable by supposing that the two unfortunate sisters were changed into birds.

PHILONIUM, in *Pharmacy*, a kind of anodyne opiate, taking its name from Philo the inventor.

Ancient Universal History, vol. vi.

PHILOPOEMEN, a celebrated general of the Achæan league, was born in Megalopolis, a city of Arcadia, in Peloponnesus; and from his very infancy discovered a strong inclination to the profession of arms. He was nobly educated by Cassander of Mantinea; a man of great probity, and uncommon abilities. He was no sooner able to bear arms than he entered among the troops which the city of Megalopolis sent to make incursions into Laconia, and in these inroads never failed to give some remarkable instance of his prudence and valour. When there were no troops in the field, he used to employ his leisure time in hunting and such other manly exercises. When Cleomenes king of Sparta attacked Megalopolis, Philopœmen displayed much courage and greatness of soul. He signalized himself no less some time after, in the battle of Sellasia, where Antigonus gained a complete victory over Cleomenes. Antigonus, who had been an eye-witness of his prudent and intrepid behaviour, made very advantageous offers to gain him over to his interest; but he rejected them, having an utter aversion to a court life, which he compared to that of a slave, saying, that a courtier was but a slave of a better condition. As he could not live idle and inactive, he went to the isle of Crete, which was then engaged in war, and served there as a volunteer till he acquired a complete knowledge of the military art; for the inhabitants of that island were in those days accounted excellent warriors, being scarce ever at peace among themselves. Philopœmen, having served some years among the troops of that island, returned home, and was upon his arrival appointed general of the horse; in which command he behaved so well, that the Achæan horse, heretofore of no reputation, became in a short time famous all over Greece. He was soon after appointed general of all the Achæan forces, when he applied himself to the re-establishing of military discipline among the troops of the republic, which he found in a very low condition, and universally despised by their neighbours. Aratus, indeed, was the first that raised the Achæan state to that pitch of power and glory to which it arrived; but the success of his enterprises was not so much owing to his courage and intrepidity as to his prudence and politics. As he depended on the friendship of foreign princes, and their powerful succours, he neglected the military discipline at home; but the instant Philopœmen was created prætor, or commander in chief, he roused the courage of his countrymen, in order to put them into a condition to defend themselves without the assistance of foreign allies. With this view he made great improvements in the Achæan discipline; changing the manner of their exercise and their arms, which were both very defective. He had thus, for the space of eight months, exercised his troops every day, making them perform all the motions and evolutions, and accustoming them to manage with dexterity their arms, when news was brought him that Machanidas was advancing, at the head of a numerous army, to invade Achaia. He was glad of this opportunity to try how the troops had profited by his discipline; and accordingly, taking the field, met the enemy in the territories of Mantinea, where a battle was fought. Philopœmen, having killed Machanidas with his own hand, struck off his head, and carried it from rank to rank, to encourage his victorious Achæans, who continued the pursuit, with great slaughter, and incredible ardour, to the city of Tegea, which they entered together with the fugitives. The Lacedæmonians lost on this occasion above 8000 men, of which 4000 were killed on the spot, and as many taken prisoners. The loss of the Achæans was very inconsiderable, and those that fell were mostly mercenaries. This happened about the year before Christ 204.

But what most of all raised the fame and reputation of Philopœmen was his joining the powerful city of Lacedæmon to the Achæan commonwealth; by which means the Achæans came to eclipse all the other states of Greece. This memorable event happened in the year 191. In this transaction we cannot help taking notice of one circumstance, which, in our opinion, reflects greater lustre on Philopœmen than all his warlike exploits. The Lacedæmonians, overjoyed to see themselves delivered from the oppressions they had long groaned under, ordered the palace and furniture of Nabis to be sold; and the sum accruing from thence, to the amount of 120 talents, to be presented to Philopœmen, as a token of their gratitude. Deputies therefore were to be appointed, who should carry the money, and desire Philopœmen, in the name of the senate, to accept of the present. On this occasion it was that the virtue of the generous Achæan appeared in its greatest lustre; for so great was the opinion which the Spartans had of his probity and disinterestedness, that no one could be found who would take upon him to offer the present: struck with veneration, and fear of displeasing him, they all begged to be excused. At last they obliged, by a public decree, one Timolaus, who had formerly been his guest, to go to Megalopolis, where Philopœmen lived, and offer him this testimony of their regard. Timolaus, with great reluctance, set out for Megalopolis, where he was kindly received and entertained by Philopœmen. Here he had an opportunity of observing the strictness of his whole conduct, the greatness of his mind, the frugality of his life, and the regularity of his manners; which struck him with such awe, that he did not dare once to mention the present he was come to offer; insomuch that, giving some other pretence to his journey, he returned home with the money. The Lacedæmonians sent him again; but he could no more prevail upon himself now than the first time to mention the true cause of his journey. At last, going a third time, he ventured, with the utmost reluctance, to acquaint Philopœmen with the offer he had to make in the name of the Lacedæmonians. Philopœmen heard him with great calmness; but the instant he had done speaking, he set out with him for Sparta, where, after having acknowledged his obligation to the Spartans, he advised them to lay out their money in reforming or purchasing those miscreants who divided the citizens, and set them at variance by means of their seditious discourses; to the end that, being paid for their silence, they might not occasion so many distractions in the government: "for it is much more advisable (said he) to stop an enemy's mouth than a friend's; as for me, I shall always be your friend, and

Philopœmen ‖ Philosopher's Stone.

you shall reap the benefit of my friendship without expence." Such was the disinterestedness of this noble Achæan!

About two years after this, the city of Messene withdrew itself from the Achæan league. Philopœmen attacked them; but was wounded, taken prisoner, and poisoned by the magistrates. Thus died one of the greatest heroes that Greece or any other country ever produced. He was no way inferior in valour, military knowledge, and virtue, to any of the boasted heroes of Rome. Had Achaia been nearer to an equality with Rome, he would have preserved his country from the yoke which the Roman republic forced it to bear. Both the Greek and Roman writers put him upon the level with Hannibal and Scipio, who were his contemporaries, and happened to die the same year. They allow him to have been not only one of the greatest commanders, but also one of the greatest statesmen of his age. To his valour and prudence Achaia owed her glory, which upon his death began to decline, there being none after him in that republic able to oppose her enemies with the like steadiness and prudence: whence Philopœmen was called the last of the Greeks, as Brutus was afterwards styled the last of the Romans.

PHILOSOPHER, a person versed in philosophy; or one who makes profession of, or applies himself to, the study of nature.

PHILOSOPHER's Stone, the greatest object of alchemy, is a long sought for preparation, which, when found, is to convert all the true mercurial part of metal into pure gold, better than any that is dug out of mines or perfected by the refiner's art.

Some Greek writers in the fourth and fifth centuries speak of this art as being then known; and towards the end of the 13th century, when the learning of the East had been brought hither by the Arabians, the same pretensions began to spread through Europe. It is supposed that this art, called *Alchemy*, was of Egyptian origin; and that when the ancient Greek philosophers travelled into Egypt, they brought back some of the allegoric language of this Egyptian art, ill understood, which afterwards passed into their mythology. Alchemy was the earliest branch of chemistry, considered as a philosophical science: in the other parts of chemical knowledge, facts preceded reasoning or speculation; but alchemy was originally speculative.

The alchemists supposed the general principles of metals to be chiefly two substances, which they called mercury and sulphur; they apprehended also, that the pure mercurial, sulphureous, or other principles of which they imagined gold to be composed, were contained separately in other bodies; and these principles, therefore, they endeavoured to collect, and to concoct and incorporate by long digestions; and by thus conjoining the principles of gold, if they could be so produced and conjoined, it might be expected that gold would be produced. But the alchemists pretend to a product of a higher order, *called the elixir, the medicine for metals, the tincture, the philosopher's stone;* which by being projected on a large quantity of any of the inferior metals in fusion, should change them into fine gold; which being laid on a plate of silver, copper, or iron, and moderately heated, should sink into the metal, and change into gold all the parts to which it was applied; which, on being properly heated with pure gold, should change the gold into a substance of the same nature and virtue with itself, so as thus to be susceptible of perpetual multiplication; and which, by continued coction, should have its power more and more exalted, so as to be able to transmute greater and greater quantities of the inferior metals, according to its different degrees of perfection.

Philosopher's Stone.

Alchemists have attempted to arrive at the making of gold by three methods: the first by separation; for every metal yet known, it is affirmed, contains some quantity of gold; only, in most, the quantity is so little as not to defray the expence of getting it out.

The second is by maturation; for the alchemists think mercury is the basis and matter of all metals; that quicksilver purged from all heterogeneous bodies would be much heavier, denser, and simpler, than the native quicksilver; and that by subtilizing, purifying, and digesting it with much labour, and long operations, it is possible to convert it into pure gold.

This method is only for mercury. With respect to the other metals, it is ineffectual, 1. Because their matter is not pure mercury, but has other heterogeneous bodies adhering to it; and, 2. Because the digestion, whereby mercury is turned into gold, would not succeed in other metals, because they had not been long enough in the mines.

Weight is the inimitable character of gold, &c. Now mercury, they say, has always some impurities in it, and these are lighter than mercury. Could they be purged away, which they think is not impossible, mercury would be as heavy as gold, and what is as heavy as gold is gold, or at least might very easily be made gold.

The third method is by transmutation, or by turning all metals readily into pure gold, by melting them in the fire, and casting a little quantity of a certain preparation into the fused matter; upon which the fæces retire, are volatilized and burnt, and carried off, and the rest of the mass is turned into pure gold. That which works this change in the metals is called the *philosopher's stone*.

Whether this third method be possible or not, it is difficult to say. We have so many testimonies of it from persons who on all other occasions speak truth, that it is hard to say they are guilty of direct falsehood, even when they say that they have been masters of the secret. We are told, that it is only doing that by art which nature does in many years and ages. For as lead and gold differ but little in weight, therefore there is not much in lead beside mercury and gold. Now, if we had any body which would so agitate all the parts of lead as to burn all that is not mercury therein, and had also some sulphur to fix the mercury, would not the mass remaining be converted into gold? There is nothing in nature so heavy as lead except gold, mercury, and platina, which was not known to these reasoners; it is evident, therefore, there is something in lead that comes very near to gold. But in lead there is likewise some heterogeneous matter different both from mercury and gold. If therefore 19 ounces of lead be dissolved by the fire, and 8 ounces be destroyed by these means, it is argued that we shall have the rest good gold; the ratio of lead to gold being as 11 to 19. If then the philosopher's stone can purify the mercurial matter in lead, so as that nothing shall remain but the pure mercurial body, and you can fix and coagulate this by means of sulphur, out of 19 ounces of lead you will have 11 of gold: or, if you reduce the lead from 18 to 14, you will then have converted it into mercury; and if you farther purify this mercury to the proper standard, you will have gold; provided you have but a sulphur with which to fix and coagulate it. Such is the foundation of the opinion of the philosopher's stone; which the alchemists contend to be a most subtile, fixed, concentrated fire, which, as soon as it melts with any metal, does, by a magnetic virtue, immediately unite itself to the mercurial body of the metal, volatilize and cleanse off all that is impure therein, and leave nothing but a mass of pure gold. Many frauds and artifices have unquestionably been practised in this operation, and there might be political reasons why princes and others should encourage those who pretended to a power of furnishing this inexhaustible source of wealth; but it would be wrong to censure as impostors all those who have declared themselves convinced, from their own experiments, of the transmutability of base metals into gold. There are strong reasons, however, to believe that the authors have been deceived themselves by fallacious appearances. Mr Boyle gives an account of a process by which he imagines part of the substance of gold to have been transmuted into silver. He also relates a very extraordinary experiment, under the title of the degradation of gold by an anti-elixir, which was published in his own life-time, and since reprinted in 1739. Hence many have been led to conclude in favour of the alchemical doctrine of the transmutability of metals. See an account of this experiment, with remarks upon it by Dr Lewis, in his *Commerce of Arts*, sect. 12. p. 297, &c.

Characters of the Kings and Queens of England.

"The opinion (says Holt) that one metallic or other foreign substance might be changed into another, was, it seems, at this time (reign of Henry VI. of England) propagated by certain chemists, whose observations on the surprising effects and alterations produced in certain substances by the force of heat carried their imaginations beyond what sound judgment might warrant. The first instance of which on record is in vol. xi. p. 68. of the *Fœdera*; wherein Henry VI. grants a licence to John Cobbe, freely to work in metals; he having, by philosophical art, found out a method of transferring imperfect metals into perfect gold and silver.

"This pretended secret, known afterwards by the name of the *Philosopher's stone* or *powder*, was encouraged by four licences, granted to different projectors during this reign, and at sundry times after, during this century particularly, and in succeeding times, all over Europe. The frenzy has not entirely ceased even to this day, although it meets with neither public encouragement nor countenance from men of sober reason; the projectors having yet found nothing from their airy schemes in this mode of search but certain ruin to their property." See CHEMISTRY.

The same author, when speaking of the commerce of the kingdom, and the wonderful increase and riches of commercial cities, speaks thus: "This is the true philosopher's stone, so much sought after in former ages, the discovery of which has been reserved to genius, when studying to improve the mechanic arts. Hence a pound of raw materials is converted into stuffs of fifty times its original value. And the metals too are not, indeed, transmuted into gold—they are more: for the labour of man has been able to work the baser metals, by the ingenuity of art, so as to become worth more than many times its weight in gold."

PHILOSOPHIC, or PHILOSOPHICAL, something belonging to PHILOSOPHY.

PHILOSOPHICAL EGG, among chemists, a thin glass body or bubble, of the shape of an egg, with a long neck or stem, used in digestions.

PHILOSOPHIZING, rules of. See NEWTONIAN *Philosophy*, N° 16. and the following article.

PHILOSOPHY

1 Definitions of philosophy.

IS a word derived from the Greek, and literally signifies the *love of wisdom* (A). In its usual acceptation, however, it denotes a science, or collection of sciences, of which the universe is the object; and of the term thus employed many definitions have been given, differing from one another according to the different views of their several authors. By Pythagoras, philosophy is defined επιστημη των οντων, "the knowledge of things existing;" by Cicero, after Plato, *scientia rerum divinarum et humanarum cum* CAUSIS; and by the illustrious Bacon, *interpretatio naturæ*. Whether any of these definitions be sufficiently precise, and at the same time sufficiently comprehensive, may be questioned; but if philosophy in its utmost extent be capable of being adequately defined, it is not here that the definition should be given. "Explanation (says an acute writer *), is the first office of a teacher; definition, if it be good, is the last of the inquirer after truth; but explanation is one thing, and definition quite another." It may be proper, however, to observe, that the definition given by Cicero is better than that of Pythagoras, because the chief object of the philosopher is to ascertain the *causes* of things; and in this consists the difference between his studies and those of the natural historian, who merely enumerates phenomena, and arranges them into separate classes.

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* *Tatham's Chart and Scale of Truth*, v. i. p. 8.

(A) The origin usually attributed to the term *philosophy* has been already assigned in the article PHILOLOGY. M. Chauvin gives it a turn somewhat different. According to him, the term is derived from φιλια, *desire* or *study*, and σοφια *wisdom*; and therefore he understands the word to mean *the desire or study of wisdom*: for (says he) Pythagoras, conceiving that the application of the human mind ought rather to be called *study* than *science*, set aside the appellation of *wise* as too assuming, and took that of *philosopher*.

2
Its objects.

The principal objects of philosophy are, God, nature, and man. That part of it which treats of God is called *theology;* that which treats of nature, *physics* and *metaphysics;* and that which treats of man, *logic* and *ethics*. That these are not separate and independent sciences, but, as Bacon expresses it (B), branches from the same trunk, we shall endeavour to show, after we have given, agreeably to our usual plan, a short history of philosophy from the earliest ages to the present day.

To attempt to assign an *origin* to philosophy, would be ridiculous; for every man endeavours to ascertain the causes of those changes which he observes in nature; and even children themselves are inquisitive after that which produces the sound of their drums and their rattles. Children, therefore, and the most illiterate vulgar, have in all ages been philosophers. But the first people among whom philosophy was cultivated as a profession, was probably the Chaldeans. We certainly read of none earlier; for though we have more authentic accounts of the Hebrews than of any other nation of remote antiquity, and have reason to believe that no people was civilized before them, yet the peculiar circumstances in which they were placed, rendered all philosophical investigation to them useless, and even tended to suppress the very spirit of inquiry. The Egyptians indeed pretended to be the first of nations, and to have spread the blessings of religion and the light of science among every other people; but, from the earliest records now extant, there is reason to believe that the Chaldeans were a civilized and powerful nation before the Egyptian monarchy was founded.

3
Philosophy of the Chaldeans.

Of the Chaldean philosophy much has been said, but very little is known. Astronomy seems to have been their favourite study; and at the era of Alexander's conquest of their country, they boasted that their ancestors had continued their astronomical observations through a period of 470,000 years. Extravagant claims to antiquity have been common in all nations (C). Calisthenes, who attended the Macedonian conqueror, was requested by Aristotle to inform himself concerning the origin of science in Chaldea; and upon examining into the grounds of this report, he found that their observations reached no farther backwards than 1903 years, or 2234 years before the Christian era. Even this is a remoter antiquity than Ptolemy allows to their science; for he mentions no Chaldean observations prior to the era of Nabonassar, or 747 years before Christ. That they cultivated something which they called philosophy at a much earlier period than this, cannot be questioned; for Aristotle †, on the credit of the most ancient records, speaks of the Chaldean magi as prior to the Egyptian priests, who were certainly men of learning before the time of Moses. For any other science than that of the stars, we do not read that the Chaldeans were famous; and this seems to have been cultivated by them merely as the foundation of judicial astrology. Persuading the multitude that all human affairs are influenced by the stars, and professing to be acquainted with the nature and laws of this influence, their *wise men* pretended to calculate nativities, and to predict good and bad fortune *. This was the source of idolatry and various superstitions; and whilst the Chaldeans were given up to such dotages, true science could not be much indebted to their labours. If any credit be due to Plutarch and Vitruvius, who quote Berosus, (see **Berosus**), it was the opinion of the Chaldean *wise men* that an eclipse of the moon happens when that part of its body which is destitute of fire is turned towards the earth. "Their cosmogony, as given by Berosus, and preserved by Syncellus, seems to be this, that all things in the beginning consisted of darkness and water; that a divine power dividing this humid mass, formed the world; and that the human mind is an emanation from the Divine nature†.

† *Apud Laert.* lib. 1. § 8.

* *Sext. Emp. ad Math.* lib. 4. § 2. *Strabo,* lib. 100. *Cic. de Div.* lib. 1. § 1.

† *Enfield's Hist. Phil.* vol. i.

The large tract of country which comprehended the empires of Assyria and Chaldea, was the first peopled region on earth. From that country, therefore, the rudiments of science must have been propagated in every direction through the rest of the world; but what particular people made the earliest figure, after the Chaldeans, in the history of philosophy, cannot be certainly known. The claim of the Egyptians is probably best founded; but as their science was the immediate source of that of the Greeks, we shall defer what we have to say of it on account of the connection between the parent and the offspring, and turn our attention from Chaldean to Indian philosophy, as it has been cultivated from a very early period by the Brachmans and Gymnosophists. We pass over Persia, because we know not of any science peculiar to that kingdom, except the doctrines of the magi, which were religious rather than philosophical; and of them the reader will find some account under the words **Magi**, **Polytheism**, and **Zoroaster**.

4
Indian philosophy.

From whatever quarter India received its wisdom, we are certain that its philosophers were held in high repute at a period of very remote antiquity, since they were visited by Pythagoras and other sages of ancient Greece, who travelled in pursuit of knowledge. Yet they seem to have been in that early age, as well as at present, more distinguished for the severity of their manners than for the acquisition of science; and, as Dr Enfield observes, to have more resembled modern monks than ancient

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(B) Convenit igitur partiri *philosophiam* in *doctrinas* tres; *doctrinam* de *numine*, *doctrinam* de *naturá*, *doctrinam* de *homine*. Quoniam autem partitiones *scientiarum* non sunt lineis diversis similes, quæ coeunt ad unum angulum; sed potius ramis arborum, qui conjunguntur in uno trunco, qui etiam truncus ad spatium nonnullum integer est et continuus, antequam se partiatur in ramos. *De aug. Scient.* lib. iii. cap. 1.

(C) This claim of the Babylonians is thus rejected with contempt by Cicero; "Contemnamus Babylonios, et eos, qui è Caucaso cœli signa servantes, numeris, et motibus, stellarum cursus persequuntur; Condemnemus, inquam, hos aut *stultitiæ*, aut *vanitatis*, aut *imprudentiæ*, qui 470 millia annorum, ut ipsi dicunt, monumentis comprehensa continent, et mentiri judicemus, nec *seculorum* reliquorum *judicium*, quod de ipsis futurum sit, *pertimescere*. *De Divinatione*, lib. i. § 19.

cient philosophers. The brachmans or bramins, it is well known, are all of one tribe; and the most learned of them are in their own language called *Pundits* or *Pandits*. The Greek writers, however, mention a society called *Samanæans*, who, voluntarily devoting themselves to the study of divine wisdom, gave up all private property, committed their children to the care of the state, and their wives to the protection of their relations. This society was supported at the public expence; and its members spent their time in contemplation, in conversation on divine subjects, or in acts of religion.

5 Ingrafted on religion.

The philosophy of the Indians has indeed from the beginning been engrafted on their religious dogmas, and seems to be a compound of fanatic metaphysics and extravagant superstition, without the smallest seasoning of rational physics. Very unlike the philosophers of modern Europe, of whom a great part labour to exclude the agency of mind from the universe, the Pandits of Hindostan allow no powers whatever to matter, but introduce the Supreme Being as the immediate cause of every effect, however trivial. "Brehm, *the Spirit of God*, (says one of their most revered Bramins), is absorbed in self-contemplation. The same is the mighty lord, who is present in every part of space, whose omnipresence, as expressed in the Reig Beid or Rigveda, I shall now explain. Brehm is one, and to him there is no second; such is truly Brehm. His omniscience is self-inspired or self-intelligent, and its comprehension includes every possible species. To illustrate this as far as I am able; the most comprehensive of all comprehensive faculties is omniscience; and being self-inspired, it is subject to none of the accidents of mortality, *conception*, *birth*, *growth*, *decay*, or *death*; neither is it subject to passion or vice. To it the three distinctions of time, *past*, *present*, and *future*, are not. To it the three modes of being (D) are not. It is separated from the universe, and independent of all. This omniscience is named *Brehm*. By this omniscient Spirit the operations of God are enlivened. By this Spirit also the 24 powers (E) of nature are animated? How is this? As the eye by the sun, as the pot by the fire, as iron by the magnet (F), as variety of imitations by the mimic, as fire by the fuel, as the shadow by the man, as dust by the wind, as the arrow by the spring of the bow, and as the shade by the tree; so by this Spirit the world is endued with the powers of intellect, the powers of the will, and the powers of action; so that if it emanates from the heart by the channel of the ear, it causes the perception of sounds; if it emanates from the heart by the channel of the skin, it causes the perception of touch; if it emanates from the heart by the channel of the eye, it causes the perception of visible objects; if it emanates from the heart by the channel of the tongue, it causes the perception of taste; if it emanates from the heart by the channel of the nose, it causes the perception of smell. This also invigorating the five members of action, and invigorating the five members of perception, and invigorating the five elements, and invigorating the five senses, and invigorating the three dispositions of the mind, &c. causes the creation or the annihilation of the universe, while itself beholds every thing as an indifferent spectator *."

6 Admits not the separate existence of matter, and

From this passage it is plain that all the motions in the universe, and all the perceptions of man, are, according to the Bramins, caused by the immediate agency of the Spirit of God, which seems to be here considered as the soul of the world. But it appears from some papers in the Asiatic Researches, that the most profound of these oriental philosophers, and even the authors of their sacred books, believe not in the existence of matter as a separate substance, but hold an opinion respecting it very similar to that of the celebrated Berkeley. The Védantis (says Sir William Jones), unable to form a distinct idea of brute matter independent of mind, or to conceive that the work of Supreme Goodness was left a moment to itself, imagine that the Deity is ever present to his work, and constantly supports a series of perceptions, which in one sense they call *illusory*, though they cannot but admit the reality of all created forms, as far as the happiness of creatures can be affected by them.

This is the very immaterialism of Berkeley; and in proof that it is the genuine doctrine of the Bramins, the learned president quotes the *Bhágavat*, which is believed to have been pronounced by the Supreme Being, and in which is the following sentence.

"Except the *first cause*, whatever may appear, and may not appear, in the mind, know that to be the mind's *Máyá*, or 'delusion,' as light, as darkness."

7 Teaches the metempsychosis.

We have shown elsewhere (see METAPHYSICS, N° 269.) that the metaphysical doctrines of the Bramins, respecting the human soul, differ not from those of Pythagoras and Plato; and that they believe it to be an emanation from the great soul of the world, which, after many transmigrations, will be finally absorbed in its parent substance. In proof of their believing in the metempsychosis, Mr Halhed gives us the following translation of what (he says) is a beautiful stanza in the Geētā: "As throwing aside his old clothes, a man puts on others that are new; so our lives, quitting the old, go to other newer animals."

8 Physics of the Bramins.

From the Bramins believing in the soul of the world not only as the *sole agent*, but as the immediate cause of every motion in nature, we can hardly suppose them

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* *Preliminary Disc. to Halhed's Gentoo Laws.*

(D) To be awake, to sleep, and to be absorbed in a state of unconsciousness—a kind of trance.

(E) The 24 powers of nature, according to the Bramins, are the five elements, *fire*, *air*, *earth*, *water*, and *akash* (a kind of subtile æther); the five members of action, the *hand*, *foot*, *tongue*, *anus*, and *male organ of generation*; the five organs of perception, the *ear*, *eye*, *nose*, *mouth*, and *skin*; the five senses, which they distinguish from the organs of sensation; the three dispositions of the mind, *desire*, *passion*, and *tranquillity*; and the power of *consciousness*.

(F) If the work from which this extract is quoted be of as great antiquity as Mr Halhed supposes, the Bramins must have been acquainted with the phenomena of magnetism at a much earlier period than any other philosophers of whom history makes mention.

to have made any great progress in that science which in Europe is cultivated under the name of *physics.* They have no inducement to investigate the laws of nature; because, according to the first principles of their philosophy, which, together with their religion, they believe to have been revealed from heaven, every phenomenon, however regular, or however anomalous, is produced by the voluntary act of an intelligent mind. Yet if they were acquainted with the use of fire-arms 4000 years ago, as Mr Halhed seems to believe, he who made that discovery must have had a very considerable knowledge of the powers of nature; for though gunpowder may have been discovered by accident in the East, as it certainly was in the West many ages afterwards, it is difficult to conceive how mere accident could have led any man to the invention of a gun. 9 Their astronomy. In astronomy, geometry, and chronology too, they appear to have made some proficiency at a very early period. (See ASTRONOMY, N° 4.). Their chronology and astronomy are indeed full of those extravagant fictions which seem to be essential to all their systems; but their calculation of eclipses, and their computations of time, are conducted upon scientific principles.

"It is sufficiently known (says Mr Davis *) that the Hindoo division of the ecliptic into signs, degrees, &c. is the same as ours; that their astronomical year is sidereal, or containing that space of time in which the sun, departing from a star, returns to the same; that it commences on the instant of his entering the sign Aries, or rather the Hindoo constellation Mesha; that each astronomical month contains as many even days and fractional parts as he stays in each sign; and that the civil differs from the astronomical account of time only in rejecting those fractions, and beginning the year and month at sunrise, instead of the intermediate instant of the artificial day or night. Hence arises the unequal portion of time assigned to each month dependent on the situation of the sun's apsis, and the distance of the vernal equinoctial colure from the beginning of Mésha in the Hindoo sphere; and by these means they avoid those errors which Europeans, from a different method of adjusting their kalendar by intercalary days, have been subject to."

Mr Davis observes, that an explanation of these matters would have led him beyond his purpose, which was only to give a general account of the method by which the Hindoos compute eclipses, and to show that the science of astronomy is as well known among them now as ever it was among their ancestors. This he does very completely; but in the present short historical sketch, we can neither copy nor abridge his memoir. Suffice it to say, that he has shown the practical part of the Hindoo astronomy to be founded on mathematical principles; and that the learned Pandits appear to have truer notions of the form of the earth, and the economy of the universe, than those which are ascribed to their countrymen in general.

The same writer shows likewise, that the prodigious duration which the Hindoos attribute to the world, is the result of a scientific calculation, founded indeed on very whimsical principles. "It has been common with astronomers to fix on some epoch, from which, as from a radix, to compute the planetary motions; and the ancient Hindoos chose that point of time counted back, when, according to their motions as they had determined them, they must have been in conjunction in the beginning of Mésha or Aries, and coeval with which circumstance they supposed the *creation.* This, as it concerned the planets only, would have produced a moderate term of years compared with the enormous antiquity that will be hereafter stated: but having discovered a slow motion of the nodes and apsides also, and taken it into computation, they found it would require a length of time corresponding with 1955884890 years now expired, when they were so situated, and 2364115110 years more before they would return to the same situation again, forming together the grand anomalistick period denominated a *Calpa*, and fancifully assigned as the day of Brahmá."

But though the mathematical part of the astronomy of the Pandits is undoubtedly respectable, their physical notions of the universe are in the highest degree ridiculous and extravagant. In the Vedas and Puranas, writings of which no devout Hindoo can dispute the divine authority, eclipses are said to be occasioned by the intervention of the monster *Rahu*; and the earth to be supported by a series of animals. 10 Strange notions of the universe. "They suppose (says Mr Halhed) that there are 14 spheres, seven below and and six above the earth. The seven inferior worlds are said to be altogether inhabited by an infinite variety of serpents, described in every monstrous figure that the imagination can suggest. The first sphere above the earth is the immediate vault of the visible heavens, in which the sun, moon, and stars, are placed. The second is the first paradise, and general receptacle of those who merit a removal from the lower earth. The third and fourth are inhabited by the souls of those men who, by the practice of virtue and dint of prayer, have acquired an extraordinary degree of sanctity. The fifth is the reward of those who have all their lives performed some wonderful act of penance and mortification, or who have died martyrs for their religion. The highest sphere is the residence of Brahma and his particular favourites, such as those men who have never uttered a falsehood during their whole lives, and those women who have voluntarily burned themselves with their husbands. All these are absorbed in the divine essence."

11 Ethics of the Hindoos. On ethics, the Hindoos have nothing that can be called philosophy. Their duties, moral, civil, and religious, are all laid down in their *Vedas* and *Shasters;* and enjoined by what they believe to be divine authority, which supersedes all reasoning concerning their fitness or utility. The business of their Pandits is to interpret those books, which are extremely ancient, and written in a language that has long been unintelligible to every other order of men; but no Pandit will alter the text, however impossible to be reconciled to principles established in his own practice of astronomy. On such occasions, the usual apology for their sacred books is, that "such things may have been so formerly, and may be so still; but that for astronomical purposes, astronomical rules must be followed *." The great duties of morality have been prescribed in every religious code; and they are not overlooked in that of the Hindoos, though the highest merit that a Bramin can have consists in voluntary acts of abstinence and mortification, and in contempt of death.

Of

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* *Asiatic Researches*, vol. ii.

* Davis's *Memoir, Asiatic Researches*, vol. ii.

12
Philosophy of the Arabians and Chinese.

Of the ancient philosophy of the Arabians and Chinese nothing certain can be said; and the narrow limits of such an abstract as this, do not admit of our mentioning the conjectures of the learned, which contradict each other, and are all equally groundless.

There is indeed sufficient evidence that both nations were at a very early period observers of the stars; and that the Chinese had even a theory by which they foretold eclipses (see ASTRONOMY, N° 2, 3.); but there is reason to believe that the Arabians, like other people in their circumstances, were nothing more than judicial astrologers, who possessed not the smallest portion of astronomical science.

Pliny makes mention of their magi, whilst later writers tell us, that they were famous for their ingenuity in solving enigmatical questions, and for their skill in the arts of divination: but the authors of Greece are silent concerning their philosophy; and there is not an Arabian book of greater antiquity than the Koran extant (see PHILOLOGY, Section II.).

13
Early science of the Phœnicians.

Leaving therefore regions so barren of information, let us pass to the Phœnicians, whose commercial celebrity has induced many learned men to allow them great credit for early science. If it be true, as seems highly probable, that the ships of this nation had doubled the Cape and almost encompassed the peninsula of Africa long before the era of Solomon (See OPHIR, N° 10.), we cannot doubt that the Phœnicians had made great proficiency in the art of navigation, and in the science of astronomy, at a period of very remote antiquity. Nor were these the only sciences cultivated by that ancient people: the learned Cudworth has, in our opinion, sufficiently proved that *Moschus* or *Mochus* a Phœnician, who, according to Strabo, flourished before the Trojan war, was the author of the atomic philosophy afterwards adopted by Leucippus, Democritus, and others among the Greeks; and that it was with some of the successors of this sage that Pythagoras, as Jamblichus tells us, conversed at Sidon, and from them received his doctrine of *Monads* (See PYTHAGORAS). Another proof of the early progress of the Phœnicians in philosophy may be found in the fragments of their historian Sanchoniatho which have been preserved by Eusebius *. We are indeed aware that men of great celebrity have called in question the authenticity of those fragments, and even the very existence of such a writer as Sanchoniatho; but for this scepticism we can discover no foundation (See SANCHONIATHO). His history may have been interpolated in some places by the translator Philo-Byblius; but Porphyry, Eusebius, and Theodoret, speak of it as a work of undoubted credit, and affirm that its author flourished before the Trojan war. Now this ancient writer teaches that, according to the *wise men* of his country, all things arose at first from the necessary agency of an active principle upon a passive chaotic mass which he calls *mot*. This chaos Cudworth thinks was the same with the elementary *water* of Thales, who was also of Phœnician extraction; but Mosheim justly observes that it was rather *dark air*, since Philo translates it αερα ζοφωδη. Be this as it may, nothing can be more evident than that the Phœnicians must have made some progress in what must surely be considered as philosophy, however false, so early as the era of Sanchoniatho; for speculations about the origin of the world never occur to untaught barbarians. Besides Mochus and Sanchoniatho, Cadmus, who introduced letters into Greece, may undoubtedly be reckoned among the Phœnician philosophers; for though it is not pretended that the alphabet was of his invention, and though it is by no means certain that the Greeks, at the time of his arrival among them, were wholly destitute of alphabetic characters (See PHILOLOGY, N° 130.); yet the man who could prevail with illiterate savages to adopt the use of strange characters, must have been a great master of the science of human nature. Several other Phœnician philosophers are mentioned by Strabo; but as they flourished at a later period, and philosophized after the systematic mode of the Greeks, they fall not properly under our notice. We pass on therefore to the philosophy of Egypt.

14
Egyptian philosophy.

It has been already observed that the Egyptians boasted of being the first of nations, and the authors of all the science which in separate rays illuminated the rest of the world. But though this claim was undoubtedly ill-founded, their high antiquity and early progress in the arts of civil life cannot be controverted. The Greeks with one voice confess that all their learning and wisdom came from Egypt, either imported immediately by their own philosophers, or brought through Phœnicia by the sages of the east; and we know from higher authority than the histories of Greece, that at a period so remote as the birth of Moses, the wisdom of the Egyptians was proverbially famous. Yet the history of Egyptian learning and philosophy, though men of the first eminence both ancient and modern have bestowed much pains in attempts to elucidate it, still remains involved in clouds of uncertainty. That they had some knowledge of physiology, arithmetic, geometry, and astronomy, are facts which cannot be questioned; but there is reason to believe that even these sciences were in Egypt pushed no farther than to the uses of life. That they believed in the existence of incorporeal substances is certain; because Herodotus assures us that they were the first assertors of the immortality, pre-existence, and transmigration of human souls, which they could not have been without holding those souls to be at least *incorporeal*, if not *immaterial*.

The author of Egyptian learning is generally acknowledged to have been *Thoth*, *Theut*, or *Taaut*, called by the Greeks *Hermes*, and by the Romans *Mercury*; but of this personage very little is known. Diodorus Siculus says that he was chief minister to Osiris, and that he improved language, invented letters, instituted religious rites, and taught astronomy, music, and other arts. The same thing is affirmed by *Sanchoniatho*, whose antiquity has been already mentioned; by *Manetho* an Egyptian priest, who flourished during the reign of Ptolemy Philadelphus; and by Plato, whose authority, as he resided long in Egypt, and was himself an eminent philosopher, is perhaps more to be depended upon than that of the other two. In the Philebus we are told that Thoth was the inventor of letters; and lest we should suppose that by those letters nothing more is meant than picture writing or symbolical hieroglyphics, it is added, that he distinguished between *vowels* and *consonants*, determining the number of each. The same philosopher, in his Phædrus, attributes to Thoth the invention of *arithmetic*, *geometry*, *astronomy*, and *hieroglyphic* learning; and subjoins a disputation said to have been held between him and *Thamus* then king of Egypt, concerning the advantage and disadvantage of his newly invented letters. Thoth boasted that the invention, by aiding memory, would greatly contribute to the progress of science; whilst the monarch contended, that it would enervate men's natural faculties by making them trust to written characters without exerting the powers of their own minds.

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* *Prep. Ev.*

All this, if real, must have happened before the era of Moses; and since it is almost certain that alphabetical characters were in use prior to the *exod* of the Israelites from Egypt (see PHILOLOGY, N° 24, 25.) we may as well allow the invention to Thoth, as give it to an earlier author of unknown name. That arithmetic, geometry, and astronomy, were cultivated in Egypt from the most remote antiquity, is affirmed by all the ancients, and made in the highest degree probable by the situation of the country. The first elements of astronomy have certainly been discovered by various nations, whose habits of life led them to the frequent observation of the heavens; and it is observed by Cicero, that the Egyptians and Babylonians, dwelling in open plains where nothing intercepted the view of the heavenly bodies, naturally devoted themselves to the study of that science. The annual overflowing of the Nile, which broke up the boundaries of their land, would lay the Egyptians under the necessity of adopting some method of settling those boundaries anew; and necessity we know to be the parent of invention. Hence their early acquaintance with practical geometry cannot well be doubted. Their custom of embalming their dead, and the perfection to which they carried that art (G), shows infallibly their knowledge of the properties of natural substances, and gives some reason to believe that they were not altogether strangers to anatomy: but if we allow them to have been at this early period anatomists acquainted with the power of drugs, we can hardly refuse them some skill in the art of physic, which they themselves traced up to their gods and demigods, to *Serapis*, *Isis*, and her son *Horus or Apollo*.

The art of alchymy has been said to have been known by the ancient Egyptians; and from the author of the Egyptian philosophy it has been called the *Hermetic* art. But though this is unquestionably a fiction, there is evidence that they were possessed of one art which is even yet a *desideratum* in the practice of chemistry. "Moses (we are told [*]) took the golden calf, which his brother had made for idolatrous purposes, and *burnt it in the fire*, and *ground it to powder*, and strewed it on the water, and made the children of Israel drink of it." Had this fact been related by Herodotus or Diodorus Siculus, it would have been deemed sufficient evidence that the Egyptians were even at that early period no strangers to the art of chemistry: and surely the evidence should not be the worse for coming from the pen of the Hebrew lawgiver, who was himself educated in the court of Egypt.

15 Not carried to high perfection.

But though it is thus evident that the rudiments of almost every useful science were known in Egypt from the remotest antiquity, it does not appear that any of them was carried to a great degree of perfection, unless perhaps chemistry alone must be excepted. One would think that no science could have been more indispensably requisite to them than geometry. And yet though Pythagoras is said to have spent 22 years in Egypt studying that science and astronomy, he himself discovered (H) the famous 47th Prop. of Euclid's first book after his return to Samos. This, though a very useful, is yet a simple theorem; and since it was not reached by the Egyptian geometry, we cannot suppose that those people had then advanced far in such speculations. The same conclusion must be drawn with respect to astronomy; for Thales is said to have been the first that calculated an eclipse of the sun; and we nowhere read that the *Egyptians* pretended to dispute that honour with him. To this it may be replied, that Pythagoras was in Egypt undoubtedly taught the true constitution of the solar system, and what is more extraordinary, the doctrine of comets in particular, and of their revolutions, like the other planets, round the sun (I). We grant that he was taught all this; but it was not scientifically, but dogmatically, as facts which the priests had received by tradition from their early ancestors, and of which they had never questioned the truth nor enquired into the reasons. Of this we need no better proof than that the Pythagorean system of the sun was totally neglected by the Greeks as soon as they began to frame hypotheses and to speculate in philosophy (K).

16 Their knowledge of the solar system.

But

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[*] Exod. xxii. 20.

(G) It is true that the dissection of some mummies has lessened the high opinion long entertained of the skill of the ancient Egyptians in the art of embalming; yet it must be granted that their knowledge of antiseptic drugs was great, since it is now certainly known, even from these dissections, that by means of such drugs they contrived to preserve rags of cloth from corruption for upwards of 3000 years.

(H) This discovery he claimed; and his claim was admitted by the Greek writers without having been *directly* controverted since. An excellent mathematician, however, has shown that the equality between the square of the hypothenuse of a right-angled triangle, and the sum of the squares on the other two sides, was known to the astronomers of India at a period long prior to that of Pythagoras. Notwithstanding this, it is certainly possible that the sage of Samos may have made the discovery himself, though we think the contrary much more probable; for we agree with the able writer already mentioned, that Pythagoras, who is generally believed to have conversed with Indian brahmans as well as Egyptian priests, may have derived from them "some of the solid as well as the visionary speculations with which he delighted to instruct or amuse his disciples." See *Transactions of the Royal Society of Edinburgh*, vol. ii. Memoir xiii. Physic Class.

(I) This is recorded by Aristotle and Plutarch; and thus expressed by Ammianus Marcellinus.—" Stellas quasdam, *ceteris similes*, quarum *ortus orbitusque*, quibus sint temporibus *præstituti* humanis mentibus ignorari, lib. xxv. cap. 10.

(K) *Fixas* in supremis mundi partibus immotas persistere, et planetas his inferiores circa solem revolvi, terram pariter moveri cursu annuo, diurno vero circa axem propriam, et solem ceu focum universi in omnium centro quiescere,

But it may seem strange, and certainly is so, that the Egyptian priests, in the days of Pythagoras, should have preserved so great a discovery of their ancestors, and at the same time have totally forgotten the principles and reasoning which led to a conclusion apparently contrary to the evidence of sense. This is a difficulty which we pretend not to remove, though the fact which involves it seems to be beyond the reach of controversy. Perhaps the following observations may throw upon it a feeble light, According to Manetho, the written monuments of the first Thoth were lost or neglected in certain civil revolutions or natural calamities which befel the kingdom of Egypt. After many ages great part of them were recovered by an ingenious interpretation of the symbols which he had inscribed upon ancient columns: and the man who made this interpretation was called the second *Thoth* or *Hermes Trismegistus*. But *thrice illustrious* as this personage was, it is at least possible that he may have been much inferior to the former Hermes, and have read his writings and transcribed his conclusions without being able to comprehend the principles or reasoning which led to those conclusions. Any man who understands Latin might translate into his own tongue the conclusions of Newton; but much more would be requisite to make him comprehend the demonstrations of his sublime geometry. By what mode of reasoning the first Hermes (L) was led to the true idea of the solar system, or whether it was by reasoning at all, cannot now be known; but it seems very evident, that when the intercourse between the Egyptians and Greeks first commenced, the wisdom of the former people consisted chiefly in the science of legislation and civil policy, and that the philosopher, the divine, the legislator, and the poet, were all united in the same person. Their cosmogony (for all the ancients who pretended to science framed cosmogonies) differed little from that of the Phœnicians already mentioned. They held that the world was produced from chaos by the energy of an intelligent principle; and they likewise conceived that there is in nature a continual tendency towards dissolution. In Plato's Timæus, an Egyptian priest is introduced describing the destruction of the world, and asserting that it will be effected by means of water and fire. They conceived that the universe undergoes a periodical conflagration; after which all things are restored to their original form, to pass again through a similar succession of changes.

17 Their moral science. *Enfield's History of Philosophy.*

"Of preceptive doctrine the Egyptians had two kinds, the one sacred, the other vulgar. The former, which respected the ceremonies of religion and the duties of the priests, was doubtless written in the sacred books of Hermes, but was too carefully concealed to pass down to posterity. The latter consisted of maxims and rules of virtue, prudence, or policy. Diodorus Siculus relates many particulars concerning the laws, customs, and manners of the Egyptians; whence it appears that superstition mingled with and corrupted their notions of morals. It is in vain to look for accurate principles of ethics among an ignorant and superstitious people. And that the ancient Egyptians merited this character is sufficiently evident from this single circumstance, that they suffered themselves to be deceived by impostors, particularly by the professors of the fanciful art of astrology; concerning whom Sextus Empiricus justly remarks, that they have done much mischief in the world, by enslaving men to superstition, which will not suffer them to follow the dictates of right reason." See EGYPT, MYSTERIES, MYTHOLOGY, &c.

18 Grecian philosophy.

From Egypt and Phœnicia philosophy passed into Greece; where it was long taught without system, as in the countries from which it was derived. Phoroneus, Cecrops, Cadmus, and Orpheus, were among the earliest instructors of the Greeks; and they inculcated Egyptian and Phœnician doctrines in detached maxims, and enforced them, not by strength of argument, but by the authority of tradition. Their cosmogonies were wholly Phœnician or Egyptian, disguised under Grecian names; and they taught a future state of rewards and punishments. The planets and the moon Orpheus conceived to be habitable worlds, and the stars to be fiery bodies like the sun: but he taught that they are all animated by divinities; an opinion which prevailed both in Egypt and the east: and it does not appear that he gave any other proof of his doctrines than a confident assertion that they were derived from some god. See ORPHEUS.

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cere, antiquissima fuit philosophantium sententia. Ab Ægyptiis autem astrorum antiquissimis observationibus propagatam esse hanc sententiam verisimile est. Et etiam ab illis et à gentibus conterminis ad Græcos, gentem magis philologicam quam philosophicam, philosophia omnis antiquior juxta et senior manasse videtur. Subinde docuerunt Anaxagoras, Democritus, et alii nonnulli, terram in centro mundi immotam stare, et astra omnia in occasum, aliqua celerius, alia tardius moveri, idque in spatiis liberrimis. Namque orbis solidi postea ab Eudoxo, Calippo, Aristotele, introducti sunt; declinante indies philosophia primitus introducta, et novis Græcorum commentis paulatim prævalentibus. Quibus *vinculis* ANTIQUI planetas in spatiis liberis retineri, deque cursu rectilineo perpetuo retractas in orbem regulariter agi docuere, non constat. *Newton de Mundi Systemate.*

(L) Some authors, deeply skilled in the Hebrew language, have thought that the true system of the sun and planets may be perceived in the Scriptures of the Old Testament, and that it is only from ignorance or carelessness of the translators that it does not appear in the English bible and other versions. The writer of this article confesses that his knowledge of the Hebrew is very limited, which is probably the reason that to him the arguments of these men appear weak and their criticisms fanciful. No man, however, has a higher veneration than he for the sacred volume, which he believes to have been given for nobler purposes that to teach its readers the science of astronomy; but could the principles of that science be found in it, he should be strongly inclined to think that the first Thoth was Joseph, and that the monarch to whom he was minister was the far-famed Osiris. Were there any solid foundation for this supposition, it would be easy to conceive how Thoth acquired his science, and how the Egyptian priests might retain just notions of the solar system in general, long after they had forgotten the evidence upon which he communicated those notions to their ancestors.

Hitherto we have seen philosophy in its state of infancy and childhood, consisting only of a collection of sententious maxims and traditionary opinions; but among the Greeks, an ingenious and penetrating people, it soon assumed the form of profound speculation and systematic reasoning. Two eminent philosophers arose nearly at the same period, who may be considered as the parents not only of Grecian science, but of almost all the science which was cultivated in Europe prior to the era of the great Lord Bacon: These were Thales and Pythagoras; of whom the former founded the Ionic school and the latter the Italic; from which two sprung the various sects into which the Greek philosophers were afterwards divided. A bare enumeration of these sects is all that our limits will admit of; and we shall give it in the perspicuous language and just arrangement of Dr Enfield, referring our readers for a fuller account than we can give of their respective merits to his abridged translation of Brucker's history.

19 The Ionic school.

Of the Ionic School were, 1. The Ionic sect proper, whose founder Thales had as his successors Anaximenes, Anaxagoras, Diogenes Apolloniates, and Archelaus. 2. The Socratic school, founded by Socrates, the principal of whose disciples were Xenophon, Æschines, Simon, Cebes, Aristippus, Phædo, Euclid, Plato, Antisthenes, Critias, and Alcibiades. 3. The Cyrenaic sect, of which Aristippus was the author; his followers were, his daughter Arete, Hegisias, Anicerris, Theodorus, and Bion. 4. The Megaric or Eristic sect, formed by Euclid of Megara; to whom succeeded Eubulides, Diodorus, and Stilpo, famous for their logical subtlety. 5. The Eliac or Eretriac school, raised by Phædo of Elis, who, though he closely adhered to the doctrine of Socrates, gave name to his school. His successors were Plistanus and Menedemus; the latter of whom, being a native of Eretria, transferred the school and name to his own country. 6. The Academic sect, of which Plato was the founder. After his death, many of his disciples deviating from his doctrine, the school was divided into the old, new, and middle academies. 7. The Peripatetic sect, founded by Aristotle, whose successors in the Lyceum were Theophrastus, Strato, Lycon, Aristo, Critolaus, and Diodorus. Among the Peripatetics, besides those who occupied the chair, were also Dicæarchus, Eudemus, and Demetrius Phalereus. 8. The Cynic sect, of which the author was Antisthenes, whom Diogenes, Onesicritus, Crates, Metrocles, Menippus, and Menedemus, succeeded. In the list of Cynic philosophers must also be reckoned Hipparchia, the wife of Crates. 9. The Stoic sect, of which Zeno was the founder. His successors in the porch were Persæus, Aristo of Chios, Herillus, Sphærus, Cleanthus, Chrysippus, Zeno of Tarsus, Diogenes the Babylonian, Antipater, Panætius, and Posidonius.

20 The Italic school.

Of the Italic School were, 1. The Italic sect proper: it was founded by Pythagoras, a disciple of Pherecydes. The followers of Pythagoras were Aristæus, Mnesarchus, Alcmæon, Ecphantus, Hippo, Empedocles, Epicharmus, Ocellus, Timæus, Archytas, Hippasus, Philolaus, and Eudoxus. 2. The Eleatic sect, of which Xenophanes was the author: his successors, Parmenides, Melissus, Zeno, belonged to the metaphysical class of this sect; Leucippus, Democritus, Protagoras, Diagoras, and Anaxarchus, to the physical. 3. The Heraclitean sect, which was founded by Heraclitus, and soon afterwards expired: Zeno and Hippocrates philosophised after the manner of Heraclitus, and other philosophers borrowed freely from his system. 4. The Epicurean sect, a branch of the Eleatic, had Epicurus for its author; among whose followers were Metrodorus, Polyænus, Hermachus, Polystratus, Basilides, and Protarchus. 5. The Pyrrhonic or Sceptic sect, the parent of which was Pyrrho: his doctrine was taught by Timon the Phliasian; and after some interval was continued by Ptolemy a Cyrenean, and at Alexandria by Ænesidemus.

Of the peculiar doctrines of these sects, the reader will in this work find a short account either in the lives of their respective founders, or under the names of the sects themselves. We shall only observe at present, that though many of them were undoubtedly absurd, and many wicked, it would yet perhaps be going too far to say with some, that the philosophy of Greece became impious under Diagoras, vicious under Epicurus, HYPOCRITICAL UNDER ZENO, impudent under Diogenes, covetous under Demochares, voluptuous under Metrodorus, fantastical under Crates, scurrilous under Menippus, licentious under Pyrrho, and quarrelsome under Cleanthes. Of the truth of this heavy charge every reader must judge for himself. We are strongly inclined to think, that there were virtues and vices peculiar to each sect; "and that the sects themselves had an affinity more or less direct with the different temperaments of man; whence the choice of sectators often depended on physical influence, or a peculiar disposition of their organs. Nothing appears more natural than that those men who were born with great force of mind and strong nerves should discover a predilection for stoicism; while mortals, endowed by nature with more delicacy of fibres and keener sensibility, fled for refuge to the myrtles of Epicurus. People whose temperaments partook of no extremes, were always inclined either for the Lyceum or the Academy. Such as possessed solidity of understanding ranged themselves with Aristotle; and those who had only genius, or even pretensions to that endowment, went to augment the crowd of Platonists."

Pauw's Philosophical Dissertation, &c.

21 Grecian mode of philosophizing.

All the systematical philosophers, however, pursued their inquiries into nature by nearly the same method. Of their philosophy, as well as of ours, the universe, with all that it contains, was the vast object; but the individuals things which compose the universe are infinite in number and ever changing; and therefore, according to an established maxim of theirs, incapable of being the subjects of human science *. To reduce this infinitude, and to fix those fleeting beings, they established certain definite arrangements or classes, to some of which every thing past, present, or to come, might be referred; and having ascertained, as they thought, all that could be affirmed or denied of these classes, they proved, by a very short process of syllogistic reasoning, that what is true of the class must be true of every individual comprehended under it. The most celebrated of these arrangements is that which is known by the name of *categories;* which Mr Harris thinks at least as old as the era of Pythagoras, and to the forming of which mankind would, in his opinion, be necessarily led by the following considerations:

22 The categories.

Every subject of human thought is either *substance* or *attribute;* but *substance* and *attribute* may each of them be modified under the different characters of *universal* or *particular*. Hence there arises a quadruple arrangement of things into *substance universal* and *substance particular;* into *attribute universal* and *attribute particular;* to some one of *which four* not only our words and ideas, but every individual of that immense multitude of things which compose the universe, may be deduced. This arrangement, however, the learned author thinks too limited; and he is of opinion, that, by attending to the substances with which they were surrounded, the Grecian schools must soon have distinguished between the attributes *essential* to all substances and those which are only *circumstantial;* between the attributes proper to *natural* substances or bodies, and those which are peculiar to *intelligible* substances or minds. He likewise thinks, that the *time* and *place* of the existence of substances not present, must soon have attracted their attention; and that in considering the place of this or that substance, they could hardly avoid thinking of its *position* or *situation*. He is of opinion, that the superinduction of one substance upon another would inevitably suggest the idea of *clothing* or *habit*, and that the variety of *co-existing substances* and *attributes* would discover to them another attribute, viz. that of *relation*. Instead therefore of confining themselves to the simple division of *substance* and *attribute*, they divided *attribute* itself into nine distinct sorts, some *essential* and others *circumstantial;* and thus by setting substance at their head, made ten *comprehensive universal genera*, called, with reference to their Greek name, *categories*, and with reference to their Latin name *predicaments*. These categories are, SUBSTANCE, QUALITY, QUANTITY, RELATION, ACTION, PASSION, WHEN, WHERE, POSITION, and HABIT; which, according to the systematic philosophy of the Greeks, comprehend every human science and every subject of human thought. *History*, natural and civil, springs, says Mr Harris, out of SUBSTANCE; *mathematics* out of QUANTITY; *optics* out of QUALITY and QUANTITY; *medicine* out of the *same; astronomy* out of QUANTITY and MOTION; *music* and *mechanics* out of the *same; painting* out of QUALITY and SITE; *ethics* out of RELATION; *chronology* out of WHEN; *geography* out of WHERE; *electricity*, *magnetism*, and *attraction*, out of ACTION and PASSION; and so in other instances.

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* *Boeth. in Prædic. et Arist. Physic. lib. i.*

23
and predicables.

To these categories, considered as a mere arrangement of science, we are not inclined to make many objections. The arrangement is certainly not complete: but this is a matter of comparatively small importance; for a complete arrangement of science cannot, we believe, be formed. The greatest objection to the categories arises from the use that was made of them by almost every philosopher of the Grecian schools; for those sages having reduced the objects of all human science to ten general heads or general terms, instead of setting themselves to inquire by a painful induction into the nature and properties of the real objects before them, employed their time in conceiving what could be predicated of *substance* in general, of this or that *quality*, *quantity*, *relation*, &c. in the abstract: and they soon found, that of such general conceptions as the *categories* there are but five *predicables* or *classes* of *predicates* in nature. The first class is that in which the *predicate* is the *genus* of the *subject;* the second, that in which it is the *species* of the *subject;* the third, is when the *predicate* is the *specific difference* of the *subject;* the fourth, when it is a *property* of the *subject;* and the fifth, when it is something *accidental* to the *subject* (see Logic, Part II. chap. ii. and iii.). Having proceeded thus far in their system, they had nothing to do with individuals but to arrange them under their proper categories, which was commonly done in a very arbitrary manner; and then, with the formality of a syllogism, to predicate of each the predicable of the genus or species to which it belonged. But by this method of proceeding, it is obvious that no progress whatever could be made in physical, metaphysical, or ethical science; for if the individual truly belongs to the category under which it is arranged, we add nothing to our stock of knowledge by affirming or denying of it what we had before affirmed or denied of the whole genus: and if it belong not to the category under which we arrange it, our syllogising will only give the appearance of proof to what must, from the nature of things, be an absolute falsehood. It is only by experiments made on various substances apparently of the same kind that they can be certainly known to belong to the same category; and, when this is done, all syllogistic reasoning from the genus to the species, and from the species to the individual, is but solemn trifling, as every proposition in this retrograde course takes for granted the thing to be proved,

24
are no instruments of science.

25
This philosophy disseminated through the whole world.

Yet this mode of philosophizing spread from Greece almost over the whole world. It was carried by Alexander into Asia, by his successors into Egypt, and it found its way to Rome after Greece became a province of the empire. It was adopted by the Jews, by the fathers of the Christian church, by the Mahommedan Arabs during the caliphate, and continued to be cultivated by the schoolmen through all Europe, till its futility was exposed by Lord Bacon (M). The professors of this philosophy often displayed great acuteness; but their systems were built on mere hypotheses, and supported by syllogistic wrangling. Now and then indeed a superior genius, such as Alhazen and our countryman Roger Bacon, broke through the trammels of the schools, and, regardless of the authority of the Stagyrite and his *categories*, made real discoveries in physical science by experiments judiciously conducted on individual substances (see Bacon, *Roger;* and Optics, N° 6.); but the science in repute still continued to be that of *Generals*.

It was indeed a combination of absurd metaphysics with more absurd theology; and that which is properly called *physics*, had in Europe no place in a liberal education from the end of the eighth century to the end of the fourteenth. Towards the beginning of this period of darkness, the whole circle of instruction, or the

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(M) Scientiæ, quas habemus, fere à Græcis fluxerunt. Quæ enim scriptores Romani, aut Arabes, aut recentiores addiderunt, non multa aut magni momenti sunt: et qualiacunque sint, fundata sunt super basin eorum quæ inventa sunt à Græcis. *Bacon.*

the liberal arts as they were called, consisted of two branches, the *trivium* and the *quadrivium*; of which the former comprehended *grammar*, *rhetoric*, and *dialectics*; the latter *music*, *arithmetic*, *geometry*, and *astronomy*, to which was added, about the end of the eleventh century, the study of a number of *metaphysical subtleties* equally useless and unintelligible.

Hitherto the works of the ancient Greek philosophers had been read only in imperfect Latin translations; and before the scholastic system was completely established, Plato and Aristotle had been alternately looked up to as the oracle in science. The rigid schoolmen, however, universally gave the preference to the Stagyrite; because his analysis of body into matter and form is peculiarly calculated to keep in countenance the most incredible doctrine of the Romish church (see TRANSUBSTANTIATION): and upon the revival of Greek learning, this preference was continued after the school philosophy had begun to fall into contempt, on account of much useful information contained in some of his writings on subjects of natural history, and his supposed merit as a natural philosopher. At last the intrepid spirit of Luther and his associates set the minds of men free from the tyranny of ancient names, as well in human science as in theology; and many philosophers sprung up in different countries of Europe, who professed either to be *eclectics*, or to study nature, regardless of every authority but that of reason. Of these the most eminent beyond all comparison was Francis Bacon Lord Verulam.

26 exposed as futile by Lord Bacon;

This illustrious man having read with attention the writings of the most celebrated ancients, and made himself master of the sciences which were then cultivated, soon discovered the absurdity of pretending to account for the phenomena of nature by syllogistic reasoning from hypothetical principles; and with a boldness becoming a genius of the first order, undertook to give a new chart of human knowledge. This he did in his two admirable works, intitled, 1. *De dignitate et augmentis scientiarum*; and, 2. *Novum organum scientiarum*, sive *Judicia vera de interpretatione Naturæ*. In the former of these works, he takes a very minute survey of the whole circle of human science, which he divides into three great branches, *history*, *poetry*, and *philosophy*, corresponding to the three faculties of the mind, *memory*, *imagination*, and *reason*. Each of these general heads is subdivided into minuter branches, and reflections are made upon the whole, which, though we can neither copy nor abridge them, will amply reward the perusal of the attentive reader. The purpose of the *Novum Organum* is to point out the proper method of interpreting nature; which the author shows can never be done by the logic which was then in fashion, but only by a painful and fair induction. "Homo naturæ minister (says he) et interpres tantum facit et intelligit, quantum de naturæ ordine re, vel mente observaverit; nec amplius scit aut potest. Syllogismus ad principia scientiarum non adhibetur, ad media axiomata frustra adhibetur, cum sit subtilitati naturæ longe impar. Assensum itaque constringit, non res. Syllogismus ex propositionibus constat, propositiones ex verbis, verba notionum tesseræ sunt. Itaque si notiones ipsæ (id quod basis rei est) confusæ sint et temere à rebus abstractæ, nihil in iis quæ superstruuntur, est firmitudinis. Itaque spes est una in *inductione vera*."

27 who establishes a better method of inquiry.

To hypotheses and preconceived opinions, which he calls *idola theatri*, this great man was not less inimical than to syllogisms; and since his days almost every philosopher of eminence, except Descartes and his followers (see DESCARTES and CARTESIANS) has professed to study nature according to the method of induction so accurately laid down in the *Novum Organum*. On this method a few improvements have perhaps been made; but notwithstanding these, Lord Bacon must undoubtedly be considered as the author of that philosophy which is now cultivated in Europe, and which will continue to be cultivated as long as men shall have more regard for matters of fact than for hypothetical opinions. Of this mode of philosophising we shall now give a short, though we hope not inaccurate, view, by stating its objects, comparing it with that which it superseded, explaining its rules, and pointing out its uses; and from this view it will appear, that its author shares with Aristotle the empire of science.

28 View of his philosophy.

THE universe, that unbounded object of the contemplation, the curiosity, and the researches of man, may be considered in two different points of view.

In the first place, it may be considered merely as a collection of existences, related to each other by means of resemblances and distinction, situation, succession, and derivation, as making parts of a whole. In this view it is the subject of pure description.

To acquire an acquaintance with, or a knowledge of, the universe in this point of view, we must enumerate all the beings in it, mention all their sensible qualities, and mark all these relations for each. But this would be labour immense; and when done, an undistinguishable chaos. A book containing every word of a language would only give us the materials, so to speak, of this language. To make it comprehensible, it must be put into some form, which will comprehend the whole in a small compass, and enable the mind to pass easily from one word to another related to it. Of all relations among words, the most obvious are those of resemblance and derivation. An etymological dictionary, therefore, in which words are classed in consequence of their resemblances, and arranged by means of their derivative distinctions, will greatly facilitate the acquisition of the language.

Just so in nature: The objects around us may be grouped by means of their resemblance, and then arranged in those groups by means of their distinctions and other relations. In this classification we are enabled to proceed by means of our faculty of abstracting our attention from the circumstances in which things differ, and turning it to those only in which they agree. By the judicious employment of this faculty we are able not only to distribute the individuals into classes, but also to distribute those classes into others still more comprehensive, by discovering circumstances of resemblance among them: for the fewer the circumstances are which concur to form that resemblance which has engaged our attention, the greater is the number of similar circumstances which are neglected; and the more extensive will be the class of individuals in which the resemblance is observed. Thus a number of individuals resembling each other in the single

29 Natural history.

single circumstance of life, composes the most extensive KINGDOM of ANIMALS. If it be required, that they shall further resemble in the circumstance of having feathers, a prodigious number of animals are excluded, and we form the inferior *class* of BIRDS. We exclude a great number of birds, by requiring a further similarity of web feet, and have the *order* of ANSERES. If we add lingua ciliata, we confine the attention to the *genus* of ANATES. In this manner may the whole objects of the universe be grouped, and arranged into kingdoms, classes, orders, genera, and species.

Such a classification and arrangement is called NATURAL HISTORY; and must be considered as the only foundation of any extensive knowledge of nature. To the natural historian, therefore, the world is a collection of existences, the subject of descriptive arrangement. His aim is threefold.

1. To observe with care, and describe with accuracy, the various objects of the universe.

2. To determine and enumerate all the great classes of objects; to distribute and arrange them into all their subordinate classes, through all degrees of subordination, till he arrive at what are only accidental varieties, which are susceptible of no farther distribution; and to mark with precision the principles of this distribution and arrangement, and the characteristics of the various assemblages.

3. To determine with certainty the particular group to which any proposed INDIVIDUAL belongs.

DESCRIPTION, therefore, ARRANGEMENT, and REFERENCE, constitute the whole of his employment; and in this consists all his science.

30 distinguished from philosophy.

Did the universe continue unchanged, this would constitute the whole of our knowledge of nature: but we are witnesses of an uninterrupted succession of changes, and our attention is continually called to the EVENTS which are incessantly happening around us. These form a set of objects vastly more interesting to us than the former; being the sources of almost all the pleasures or pains we receive from external objects.

We are therefore much interested in the study of the events which happen around us, and strongly incited to prosecute it: but they are so numerous and so multifarious, that the study would be immense, without some contrivance for abbreviating and facilitating the task. The same help offers itself here as in the study of what may be called *quiescent nature*. Events, like existences, are susceptible of classification, in consequence of resemblances and distinction; and by attention to these, we can acquire a very extensive acquaintance with active nature. Our attention must be chiefly directed to those circumstances in which many events resemble each other, while they differ perhaps in a thousand others. Then we must attend to their most general distinctions; then to distinctions of smaller extent, and so on.

It is in this way accordingly that we have advanced in our knowledge of active nature, and are gradually, and by no means slowly, forming assemblages of events more and more extensive, and distributing these with greater and greater precision into their different classes.

In the zealous and attentive prosecution of this task a very remarkable and interesting observation occurs: In describing those circumstances of similarity among events, and particularly in distributing them according to those similarities, it is impossible for us to overlook that constancy which is observed in the changes of nature in the events which are the objects of our contemplation. Events which have once been observed to accompany each other are observed always to do so.

31 Constancy in the changes of nature

The rising of the sun is always accompanied by the light of day, and his setting by the darkness of night. Sound argument is accompanied by conviction, impulse by motion, kindness by a feeling of gratitude, and the perception of good by desire. The unexcepted experience of mankind informs us, that the events of nature go on in certain regular trains; and if sometimes exceptions seem to contradict this general affirmation, more attentive observation never fails to remove the exception. Most of the spontaneous events of nature are very complicated; and it frequently requires great attention and penetration to discover the simple event amidst a crowd of unessential circumstances which are at once exhibited to our view. But when we succeed in this discovery, we never fail to acknowledge the perfect uniformity of the event to what has been formerly observed.

32 universally expected.

But this is not all: We firmly *believe* that this uniformity will *still continue;* that fire will melt wax, will burn paper, will harden clay, as we have formerly observed it to do; and whenever we have undoubted proofs that the circumstances of situation are precisely the same as in some former case, though but once observed, we expect with irresistible and unshaken confidence that the event will also be the same.

It is not surely necessary to adduce many proofs of the universality of this law of human thought. The whole language and actions of men are instances of the fact. In all languages there is a mode of construction which is used to express this relation as distinct from all others, and the conversation of the most illiterate never confounds them, except when the conceptions themselves are confounded. The general employment of the active and passive verb is regulated by it. *Turris eversa est à militibus; turris eversa est terræ motu*, express two relations, and no schoolboy will confound them. The distinction therefore is perceived or felt by all who can speak grammatically. Nor is any language without general terms to express this relation, cause—effect—to occasion. Nay, it is a fact in the mind of brutes, who hourly show that they expect the same uses of every subject which they formerly made of it; and without this, animals would be incapable of subsistence, and man incapable of all improvement. From this alone memory derives all its value; and even the constancy of natural operation would be useless if not matched or adapted to our purposes by this expectation of any confidence in that constancy.

After all the labours of ingenious men to discover the foundation of this irresistible expectation, we must be contented with saying that such is the constitution of the human mind. It is an *universal fact* in human thought; and for any thing that has been yet discovered, it is an *ultimate* fact, not included in any other still more general. We shall soon see that this is sufficient for making it the foundation of true human knowledge; all of which must in like manner be reduced to ultimate facts in human thought.

We must consider this undoubted feeling, this persuasion of the constancy of nature, as an *instinctive* anticipation of events similar to those which we have already experienced. The general analogy of nature should have disposed philosophers to acquiesce in this, however unwelcome to their vanity. In no instance of essential consequence to our safety or well-being are we left to the guidance of our boasted reason; God has given us the surer conduct of natural instincts. No case is so important as this: In none do we so much stand in need of a guide which shall be powerful, infallible, and rapid in its decisions. Without it we must remain incapable of all instruction from experience, and therefore of all improvement.

Our sensations are undoubtedly feelings of our mind. But all those feelings are accompanied by an instinctive reference of them to something distinct from the feelings themselves. Hence arises our perception of external objects and our very notions of this externeity (pardon the term). In like manner, this anticipation of events, this irresistible connection of the idea of fire with the idea of burning, is also a feeling of the mind: and this feeling is by a law of human nature referred, without reasoning, to something external as its cause; and, like our sensation, it is considered as a *sign* of that external something. It is like the conviction of the truth of a mathematical proposition. This is referred by us to something existing in nature, to a necessary and external relation subsisting between the ideas which are the subjects of the proposition. The conviction is the sign or indication of this relation by which it is brought to our view. In precisely the same manner, the irresistible connection of ideas is interpreted as the sensation or sign of a *necessary connection* of external things or events. These are supposed to include something in their nature which renders them inseparable companions.

33 Our knowledge of causation.

To this bond of connection between external things we give the name of CAUSATION. All our knowledge of this relation of cause and effect, is the knowledge or consciousness of what passes in our own minds during the contemplation of the phenomena of nature. If we adhere to this view of it, and put this branch of knowledge on the same footing with those called the *abstract sciences*, considering only the *relations* of ideas, we shall acquire *demonstrative science*. If we take any other view of the matter, we shall be led into inextricable mazes of uncertainty and error.

We see then that the natural procedure of our faculty of abstraction and arrangement, in order to acquire a more speedy and comprehensive knowledge of natural events, presents them to our view in another form. We not only see them as *similar* events, but as events naturally and necessarily *conjoined*. And the expression of *resemblance* among events is also an expression of *concomitancy*; and this arrangement of events in consequence of their resemblance is in fact the *discovery* of those accompaniments. The trains of natural appearance being considered as the appointments of the Author of Nature, has occasioned them to be considered also as consequences of *laws* imposed on his works by their great author, and every thing is said to be regulated by fixed laws. But this is the language of analogy.

34 Laws of nature explained.

When a sovereign determines on certain trains of conduct for his subjects, he issues his orders. These orders are laws. He inforces the observance of them by his authority; and thus a certain regularity and constancy of conduct is produced. But should a stranger, ignorant of the promulgation of these laws, and of the exerted authority of the magistrate, observe this uniformity of conduct, he would ascribe it to the genius and disposition of the people; and his observation would be as useful to him for directing the tenor of his own conduct, as the knowledge of the subject himself of the real source of this constancy is for directing his.

Just so in nature, while the theologian pretends, from his discoveries concerning the existence and superintendance of God, to know that the constant accompaniment of events is the consequence of laws which the great Author and Governor of the universe has imposed on his works, the ordinary philosopher, a stranger to this scene, and to the unsearchable operations of the SUPREME MIND, must ascribe this constancy to the nature of the things. There is a great resemblance between the expression *natural law* and *grammatical rule*. Rule in strict language implies command; but in grammar it expresses merely a generality of *fact*, whether of flexion or construction. In like manner, a LAW OF NATURE is to the philosopher nothing but the expression of a generality of fact. A natural or physical law is a generally observed fact; and whenever we treat any subject as a generally observed fact, we treat it physically. It is a physical law of the understanding that argument is accompanied by conviction; it is a physical law of the affection that distress is accompanied by pity; it is a physical law of the material world that impulse is accompanied by motion.

And thus we see that the arrangement of events, or the discovery of those general points of resemblance, is in fact the discovery of the laws of nature; and one of the greatest and most important is, that the laws of nature are constant.

There is no question that this view of the universe is incomparably more interesting and important than that which is taken by the natural historian; contemplating every thing that is of value to us, and, in short, the whole life and movement of the universe.

35 Object of philosophy.

This study, therefore, has been dignified with the name of PHILOSOPHY and of SCIENCE; and natural history has been considered as of importance only in so far as it was conducive to the successful prosecution of philosophy.

But the philosopher claims a superiority on another account: he considers himself as employed in the discovery of causes, saying that philosophy is the study of the objects of the universe as related by causation, and that it is by the discovery of these relations that he communicates to the world such important knowledge. Philosophy, he says, is the science of causes. The vulgar are contented to consider the prior of two inseparably conjoined events as the cause of the other; the stroke on a bell, for instance, as the cause of sound. But it has been clearly shown by the philosopher, that between the blow on the bell and the sensation of sound there are interposed a long train of events. The blow sets the bell a trembling; this agitates the air in contact with the bell; this agitates the air immediately beyond it; and thus between the bell and the ear may be

36 Causes.

interposed a numberless series of events, and as many more between the first impression on the ear and that last impression on the nerve by which the mind is affected. He can no longer therefore follow the nomenclature of the vulgar. Which of the events of this train therefore is the cause of the sensation? None of them: It is that *something* which inseparably connects any two of them, and constitutes their bond of union. These bonds of union or causes he considers as residing in one or both of the connected objects: diversities in this respect must therefore constitute the most important distinctions between them. They are therefore with great propriety called the *qualities*, the *properties* of these respective subjects.

As the events from which we infer the existence of these qualities of things resemble in many respects such events as are the consequences of the exertion of our own powers, these qualities are frequently denominated POWERS, forces, energies. Thus, in the instance just now given of the sound of a bell, we infer the powers of impulse, elasticity, nervous irritability, and animal sensibility.

37
inferred from effects.

In consequence of this inference of a necessary connection between the objects around us, we not only infer the posterior event from the prior, or, in common language, the effect from the cause, but we also infer the prior from the posterior, the cause from the effect. We not only expect that the presence of a magnet will be followed by certain motions in iron-filings, but when we observe such motions, we infer the presence and agency of a magnet. Joy is inferred from merriment, poison from death, fire from smoke, and impulse from motion. And thus the appearances of the universe are the indications of the powers of the objects in it. Appearances are the language of nature, informing us of their causes. And as all our knowledge of the sentiments of others is derived from our confidence in their veracity; so all our knowledge of nature is derived from our confidence in the constancy of natural operations. A veracity and credulity necessarily resulting from that law of our mental constitution by which we are capable of speech, conduct us in the one case; and the constancy of nature, and the principle of induction, by which we infer general laws from particular facts, conduct us in the other. As human sentiment is inferred from language, and the existence of external things from sensation; so are the laws of nature, and the powers of natural objects, inferred from the phenomena. It is by the successful study of this language of nature that we derive useful knowledge. The knowledge of the influence of motives on the mind of man enables the statesman to govern kingdoms, and the knowledge of the powers of magnetism enables the mariner to pilot a ship through the pathless ocean.

38
Discoveries of Aristotle and Newton compared.

Such are the lofty pretensions of philosophy. It is to be wished that they be well founded; for we may be persuaded that a mistake in this particular will be fatal to the advancement of knowledge. An author of great reputation † gives us an opportunity of deciding this question in the way of experiment. He says that the ancients were philosophers, employed in the discovery of causes, and that the moderns are only natural historians, contenting themselves with observing the laws of nature, but paying no attention to the causes of things. If he speak of their *professed* aim, we apprehend that the assertion is pretty just in general. With very few exceptions indeed it may be affirmed of his favourite Aristotle, the philosopher κατ' ἐξοχην, and of Sir Isaac Newton. We select these two instances, both because they are set in continual opposition by this author, and because it will be allowed that they were the most eminent students of nature (for we must not yet call them philosophers) in ancient and modern times. Aristotle's professed aim, in his most celebrated writings, is the investigation of causes; and in the opinion of this author, he has been so successful, that he has hardly left any employment for his successors beside that of commenting upon his works. We must on the other hand acknowledge that Newton makes no such pretensions, at least in that work which has immortalized his name, and that his professed aim is merely to investigate the *general* laws of the planetary motions, and to apply these to the explanation of particular phenomena. Nor will we say that he has left no employment for succeeding inquirers; but on the contrary, confess that he has only begun the study, has discovered but one law, and has enabled us to explain only the phenomena comprehended in it alone. But he has not been unsuccessful; his investigation has been complete; and he has discovered, beyond all possibility of contradiction, a *fact* which is observed through the whole extent of the solar system; namely, that every body, nay, that every particle in it, is continually DEFLECTED toward every other body; and that every deflection is, in every instance, proportional to the quantity of matter in that body toward which the deflection is directed, and to the reciprocal of the square of the distance from it. He has therefore discovered a physical law of immense extent. Nor has he been less successful in the explanation of particular phenomena. Of this there cannot be given a better instance than the explanation of the lunar motions from the theory of gravity begun by Newton "Mathesi sua facem præferente;" and now brought to such a degree of perfection, that if the moon's place be computed from it for any moment within the period of two thousand years back, it will not be found to differ from the place on which she was actually observed by one hundredth part of her own breadth.

Discimus hinc tandem qua causa argentea Phœbe
Passibus haud æquis eat, et cur, subdita nulli
Hactenus astronomo, numerorum frena recusat.
Quæ toties animos veterum torsere sophorum,
Quæque scholas hodie rauco certamine vexant,
Obvia conspicimus, nube pellente mathesi;
Qua superos penetrare domos, et ardua cœli
Newtoni auspiciis jam dat contingere templa.

We may now desire the champions of the science of causes to name any one cause which has really been discovered by their great master, whether in the operations of mind or of body. But they must not on this occasion adduce the investigation of any natural law, in which he has sometimes succeeded. With still greater confidence may we challenge them to produce any remarkable instance of the explanation of natural phenomena either of mind or body. By explanation we mean an account of the production, and an appreciation of all the circumstances, susceptible of a scrupulous comparison with fact, and perfectly consistent with it. It is here that the weakness of this philosopher's pretensions is most conspicuous; and his followers candidly acknowledge, that in the inquiries which proceed by experiment, we have not derived great assistance from Aristotle's philosophy. But this, say they, does not derogate from the pre-eminence of his philosophy, because he has shown that the *particular* fields of observation are to be cultivated only by means of experiment. But surely every field of *observation* is particular. There is no *abstract*

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† *Ancient Metaphysics.*

abstract object of philosophical research, the study of which shall terminate in the philosophy of universals. In every kind of inquiry, that cause alone must be supposed to act which we understand so far as to be able to appreciate its effects in particular circumstances, and compare them with fact, and see their perfect coincidence. If we have discovered causes, they are *known* as far as they are discovered. Their genuine effects are known, and therefore the phenomena which result from their agency are understood. When therefore it is acknowledged, as it must be acknowledged, that mankind have made but little advances in the knowledge of nature, notwithstanding the pretended discovery of causes by Aristotle, and the conducting clue of his philosophy, till of late years; and when it is also allowed that *now*, while we are every day making great additions to this subordinate knowledge, the causes which Aristotle has discovered are forgotten, and his philosophy is neglected; there is great room for suspecting (to say the least), that either the causes which philosophy pretends to have discovered are not real, or that Aristotle and his followers have not aimed at the discovery of causes, but only at the discovery of natural laws, and have failed in the attempt.

39 Philosophical causes discovered

There seems here to be a previous question: *Is it possible to discover a philosophical cause*, that something which is neither the prior nor the posterior of the two *immediately* adjoining events, but their bond of union, and this distinct from the union itself? It is evident that this is an inquiry purely experimental. It is of *human knowledge* we speak. This must depend on the nature of the human mind. This is a matter of contingency, known to us only by experiment and observation. By observing all the feelings and operations of the mind, and classing and arranging them like any other object of science, we discover the general laws of human thought and human reasoning; and this is all the knowledge we can ever acquire of it, or of any thing else.

Much has been written on this subject. The most acute observation and sound judgment have been employed in the study; and we may venture to say, that considerable progress has been made in pneumatology. Many laws of human thought have been observed, and very distinctly marked; and philosophers are busily employed, some of them with considerable success, in the distribution of them into subordinate classes, so as to know their comparative extent, and to mark their distinguishing characters with a precision similar to what has been attained in botany and other parts of natural history; so that we may hope that this study will advance like others. But in all these researches, no phenomena have occurred which look like the perception or contemplation of these separate objects of thought, these philosophical causes, this POWER in abstracto. No philosopher has ever pretended to state such an object of the mind's observation, or attempted to group them into classes.

40 in the events.

We may say at once, without entering into any detail, that those causes, those bonds of necessary union between the naturally conjoined events or objects, are not only perceived *by means* of the events alone, but are perceived solely *in* the events, and cannot be distinguished from the conjunctions themselves. They are neither the objects of separate observation, nor the productions of memory, nor inferences drawn from reflection on the laws by which the operation of our own minds are regulated; nor can they be derived from other perceptions in the way of argumentative inference. We cannot infer the paroxysm of terror from the appearance of impending destruction, or the fall of a stone when not supported, as we infer the incommensurability of the diagonal and side of a square. This last is *implied* in the very conception or notion of a square; not as a consequence of its other properties, but as one of its essential attributes: and the contrary proposition is not only false, but incapable of being distinctly conceived. This is not the case with the other phenomenon, or any matter of fact. The proofs which are brought of a mathematical proposition, are not the reason of its being true, but the steps by which this truth is brought into our view; and frequently, as in the instance now given, this truth is perceived, not directly, but consequentially, by the inconceivableness of the contrary proposition.

41 Mr Hume's theory a *petitio principii*.

Mr Hume derives this irresistible expectation of events from the known effect of custom, the association of ideas. The corelated event is brought into the mind by this well known power of custom, with that vivacity of conception which constitutes belief or expectation. But without insisting on the futility of his theory of belief, it is sufficient to observe, that this explanation begs the very thing to be proved, when it ascribes to custom a *power* of any kind. It is the origin of this very power which is the subject in dispute. Besides, on the genuine principles of scepticism, this custom involves an acknowledgement of past events, of a something different from present impressions, which, in this doctrine (if doctrine it can be called), are the only certain existences in nature: and, lastly, it is known that *one* clear experience is a sufficient foundation for this unshaken confidence and anticipation. General custom can never, on Mr Hume's principles, give superior vivacity to any particular idea.

42 Another hypothesis respecting causal connection.

This certain nonentity of it as a separate object of observation, and this impossibility to derive this notion of necessary and causal connection between the events of the universe from any source, have induced two of the most acute philosophers of Europe, Mr Leibnitz and Father Malebranche, to deny that there is any such connection, and to assert that the events of the universe go on in corresponding trains, but without any causal connection, just as a well regulated clock will keep time with the motions of the heavens without any kind of dependence on them. This harmony of events was pre-established by the Author of the Universe, in subserviency to the purposes he had in view in its formation.

All those purposes which are cognisable by us, may certainly be accomplished by this perfect adjustment. But without insisting on the fantastic wildness of this ingenious whim, it is quite enough to observe, that it also is a begging of the question, because it supposes causation when it ascribes all to the agency of the Deity.

Thus have we searched every quarter, without being able to find a source from which to derive this perception of a necessary connection among the events of the universe, or of this confident expectation of the continuance of physical laws; and yet we are certain of the feeling, and of the persuasion, be its origin what it may: for we speak intelligibly on this subject; we speak familiarly of cause, effect, power, energy, necessary connection, motives and their influence, argument and conviction,

viction, reasons and persuasion, allurements and emotions, of gravity, magnetism, irritability, &c.; and we carry on conversations on these subjects with much entertainment and seeming instruction. Language is the expression of thought, and every word expresses some notion or conception of the mind; therefore it must be allowed, that we have such notions as are expressed by cause, power, energy. But it is here, as in many cases, we perceive a distinction without being able to express it by a definition; and that we do perceive the relation of causation as distinct from all others, and in particular as distinct from the relation of contiguity in time and place, or the relation of agent, action, and patient, must be concluded from the uniformity of language, which never confounds them except on purpose, and when it is perceived. But even here we shall find, that none of the terms used for expressing those powers of substance which are conceived as the causes of their characteristic phenomena, really express any thing different from the phenomena themselves. Let any person try to define the terms gravity, elasticity, sensibility, and the like, and he will find that the definition is nothing but a description of the phenomenon itself. The words are all derivatives, most of them verbal derivatives, implying action, gravitation, &c. As the general resemblances in shape, colour, &c. are expressed by the natural historian by generic terms, so the general resemblances in event are expressed by the philosopher in generic propositions, which, in the progress of cultivation, are also abbreviated into generic terms.

43
The perception of this connection a first principle.

This abundantly explains the consistency of our language on this subject, both with itself and with the operations of nature, without however affording any argument for the truth of the assumption, that causes are the objects of philosophic research as separate existences; or that this supposed necessary connection is a *necessary truth*, whether supreme or subordinate. But since the perception of it has its foundation in the constitution of the human mind, it seems intitled to the name of a *first principle*. We are hardly allowed to doubt of this, when we consider the importance of it, and the care of nature to secure us in all things essential to our safety and well-being, from all danger, from inattention, ignorance, or indolence, by an instinct infallible in its information, and instantaneous in its decisions. "It would not be like her usual care (says Hume), if this operation of the mind, by which we infer like effects from like causes, and *vice versa*, were entrusted to the fallacious deduction of our reason, which is slow in its operations, appears not in any degree during the first years of infancy, and in every age and period of human life is extremely liable to error. It is more conformable to her *ordinary caution* (mark the acknowledgement) to secure so necessary an act of the mind by some instinct, or blind tendency, which may be infallible and rapid in all its operations, may discover itself at the first appearance of life, and may be independent of all the laboured deductions of reason. As she has taught us the use of our limbs, without giving us any knowledge of the nerves and muscles by which they are actuated; so she has implanted in us an instinct, which carries forward the thought in a course conformable to that established among external objects, though we be ignorant of the powers and forces on which this regularity depends."

Such a knowledge is quite unnecessary, and therefore causes are no more cognisable by our intellectual powers than colours by a man born blind; nay, whoever will be at the pains to consider this matter agreeably to the received rules and maxims of logic, will find that necessary connection, or the bond of causation, can no more be the subject of philosophical discussion by man, than the ultimate nature of truth. It is precisely the same absurdity or incongruity, as to propose to examine light with a microscope. Other rational creatures may perceive them as easily as we hear sounds. All that we can say is, that their existence is probable, but by no means certain. Nay, it may be (and we may never know it) that we are not the efficient causes of our own actions, which may be effected by the Deity or by ministering spirits; and this may even be true in the material world. But all this is indifferent to the real occupation of the philosopher, and does not affect either the certainty, the extent, or the utility of the knowledge which he may acquire.

44
The object of the philosopher the discovery of physical laws.

We are now able to appreciate the high pretensions of the philosopher, and his claim to scientific superiority. We now see that this can neither be founded on any scientific superiority of his object, nor of his employment. His object is not causes; and his discoveries are nothing but the discovery of general facts, the discovery of physical laws: and his employment is the same with that of the descriptive historian. He observes and describes with care and accuracy the events of nature; and then he groups them into classes, in consequence of resembling circumstances, detected in the midst of many others which are dissimilar and occasional. By gradually throwing out more circumstances of resemblance, he renders his classes more extensive; and, by carefully marking those circumstances in which the resemblance is observed, he characterises all the different classes: and, by a comparison of these with each other, in respect to the number of resembling circumstances, he distributes his classes according to their generality and subordination; thus exhausting the whole assemblage, and leaving nothing unarranged but accidental varieties. In this procedure it is to be remarked, that every grouping of similar events is, *ipso facto*, discovering a general fact, a physical law; and the expression of this assemblage is the expression of the physical law. And as every observation of this constancy of fact affords an opportunity for exerting the instinctive inference of natural connection between the related subjects, every such observation is the discovery of a power, property, or quality, of natural substance. And from what has been said, this observation of event is all we know of the connection, all we know of the natural power. And when the philosopher proceeds farther to the arrangement of events, according to their various degrees of complication, he is, *ipso facto*, making an arrangement of all natural powers according to their various degrees of subordinate influence. And thus his occupation is perfectly similar to that of the descriptive historian, classification and arrangement; and this constitutes all the science attainable by both.

45
Philosophy defined.

PHILOSOPHY may therefore be defined, the study of the phenomena of the universe, with a view to discover the general laws which indicate the powers of natural substances, to explain subordinate phenomena, and to improve art: Or, in compliance with that natural instinct so much spoken of, Philosophy is the study of the phenomena of the universe, with a view to discover their causes, to explain subordinate phenomena, and to improve art.

The task is undoubtedly difficult, and will exercise our noblest powers. The employment is manly in itself, and the result of it important. It therefore justly merits the appellation of *philosophy*, although its objects are nowise different from what occupy the attention of other men.

46 The employment of the philosopher.

The employment of the philosopher, like that of the natural historian, is threefold; DESCRIPTION, ARRANGEMENT and REFERENCE; while the objects are not *things* but *events*.

The description, when employed about events, may be more properly termed *history*. A philosophical history of nature consists in a complete or copious enumeration and narration of facts, properly selected, cleared of all unnecessary or extraneous circumstances, and accurately narrated. This constitutes the materials of philosophy. We cannot give a better example of this branch of philosophical occupation than astronomy.

From the beginning of the Alexandrian school to this day, astronomers have been at immense pains in observing the heavenly bodies, in order to detect their true motions. This has been a work of prodigious difficulty: for the appearances are such as might have been exhibited although the real motions had been extremely different. Not that our senses give us false information; but we form hasty, and frequently false judgments, from these informations; and call those things deceptions of sense, which are in fact errors of judgment. But the true motions have at last been discovered, and have been described with such accuracy, that the history may be considered as nearly complete. This is to be found in the usual systems of astronomy, where the tables contain a most accurate and synoptical account of the motion; so that we can tell with precision in what point of the heavens a planet *has been* seen at any instant that can be named.

47 Phenomenology.

Sir Isaac Newton's Optics is such another perfect model of philosophical history, as far as it goes. This part of philosophy may be called PHENOMENOLOGY.

Having in this manner obtained the materials of philosophical description, we must put them into a compendious and perspicuous form, so that a general knowledge of the universe may be easily acquired and firmly retained. This is to be done by classification and arrangement, and this classification must proceed on resemblances *observed* in the events; and the subsequent arrangement must be regulated by the distinctions of which those resemblances are still susceptible. This assemblage of events into groups must be expressed. They are facts; therefore the expression must be propositions. These propositions must be what the logicians call *general* or *abstract propositions;* for they express, not any individual fact of the assemblage, but that circumstance in which they all resemble. Such propositions are the following: Proof is accompanied by belief; kindness is accompanied by gratitude; impulse is accompanied by motion. These are usually called *general facts;* but there are none such; every fact is individual. This language, however inaccurate, is very safe from misconstruction, and we may use it without scruple. These propositions are NATURAL OR PHYSICAL LAWS; and then the detecting and marking those resemblances in event, is the investigation of physical laws; and we may denominate this employment of the philosopher INVESTIGATION.

48 Investigation.

In the prosecution of this task, it will be found that the similarities of fact are of various extent: and thus we shall form physical laws of various extent; and we shall also find that some are subordinate to others; for the resemblance of a number of facts in one circumstance does not hinder a part of them from also resembling in another circumstance: and thus we shall find subordinations of fact in the same way as of quiescent qualities. And it is found here, as in natural history, that our assemblage of resembling events will be the more extensive as the number of resembling circumstances is smaller; and thus we shall have kingdoms, classes, orders, genera, and species of phenomena, which are expressed by physical laws of all those different ranks.

It has been already observed, that this observation of physical laws is always accompanied by a reference of that uniformity of event to a natural bond of union between the concomitant facts which is conceived by us as the *cause* of this concomitancy; and therefore this procedure of the philosopher is considered as the discovery of those causes, that is, the discovery of those powers of natural substances which constitute their physical relations, and may justly be called their distinguishing *qualities* or *properties*. This view of the matter gives rise to a new nomenclature and language. We give to those powers generic names, such as *sensibility*, *intelligence*, *irritability*, *gravity*, *elasticity*, *fluidity*, *magnetism*, &c. These terms, without exception, mark resembling circumstances of event; and no other definition can be given of them but a description of these circumstances. In a few cases which have been the subjects of more painful or refined discussion, we have proceeded farther in this abbreviation of language.

We have framed the verb "to gravitate," and the verbal noun "gravitation," which purely expresses the fact, the phenomenon; but is conceived to express the *operation* or energy of the cause or natural power. It is of importance to keep in mind this metaphysical remark on these terms; for a want of attention to the pure meaning of the words has frequently occasioned very great mistakes in philosophical science.

We may with propriety call this part of the philosopher's employment AITIOLOGY.

49 Aitiology.

We shall give an instance of its most successful application to the class of events already adduced as an example of philosophic history or phenomenology.

50 Kepler's laws an instance.

Kepler, a celebrated Prussian astronomer, having maturely considered the phenomena recorded in the tables and observations of his predecessors, discovered, amidst all the varieties of the planetary motions, three circumstances of resemblance, which are now known by the name of *Kepler's laws*.

1. All the planets describe ellipses, having the sun in one focus.

2. The elliptic areas described by a planet in the different parts of its orbit, are proportional to the times of description.

3. The squares of the periodic times are proportional to the cubes of the mean distances from the sun.

By this observation or discovery, the study of the planetary motions were greatly promoted, and the calculation of their appearances was now made with a facility and an accuracy which surpassed all hopes: for the calculation of the place of a planet at any proposed instant was reduced to the geometrical problem of cutting off an area from an ellipse of known dimensions, which should bear the same proportion to the whole area, as the time for whose duration the motion is required, has to the known time of a complete revolution.

51
Comprehended under one more general law,

Long after this discovery of Kepler, Sir Isaac Newton found that these laws of Kepler were only particular cases of a fact or law still more general. He found that the deflections of the planets from uniform rectilineal motion were all directed to the sun; and that the simultaneous deflections were inversely proportional to the squares of the distances from that body.

Thus was established a physical law of vast extent: but further observation showed him, that the motion of every body of the solar system was compounded of an original motion of projection, combined with a deflection towards every other body; and that the simultaneous deflections were proportional to the quantity of matter in the body towards which they were directed, and to the reciprocal of the square of the distance from it. Thus was the law made still more general. He did not stop here. He compared the deflection of the moon in her orbit with the simultaneous deflection of a stone thrown from the hand, and describing a parabola; and he found that they followed the same law, that is, that the deflection of the moon in a second, was to that of the stone in the same time, as the square of the stone's distance from the centre of the earth, to the square of the moon's distance from it. Hence he concluded, that the deflection of a stone from a straight line was just a particular instance of the deflections which took place through the whole solar system.

52
called *gravitation.*

The deflection of a stone is one of the indications it gives of its being *gravis* or heavy; whence he calls it *gravitation.* He therefore expresses the physical law which obtains through the whole solar system, by saying that "every body *gravitates* to every other body; and the gravitations are proportional to the quantity of matter in that other body, and inversely proportional to the square of the distance from it."

Thus we see how the arrangement of the celestial phenomena terminated in the discovery of physical laws; and that the expression of this arrangement is the law itself.

Since the fall of a heavy body is one instance of the physical law, and since this fall is considered by all as the effect of its *weight,* and this weight is considered as the cause of the fall, the same cause is assigned for all the deflections observed in the solar system; and all the matter in it is found to be under the influence of this cause, or to be heavy: and thus his doctrine has been denominated the *system of universal gravitation.*

Philosophers have gone farther, and have supposed that gravity is a power, property, or quality, residing in all the bodies of the solar system. Sir Isaac Newton does not expressly say so, at least in that work where he gives an account of these discoveries. He contents himself with the immediate consequence of the first axiom in natural philosophy, viz. that every body remains in a state of rest, or of uniform rectilineal motion, unless affected by some moving force. Since the bodies of the solar system are neither in a state of rest, nor of uniform rectilineal motion, they must be considered as so affected; that is, that there operates on every one of them a moving force, directed towards all the others, and having the proportions observed in the deflection.

53
Attempts to include this law under impulse,

Other philosophers have endeavoured to show, that this general fact, detected by Sir Isaac Newton, is included in another still more general, viz. that every body moves which is impelled by another body in motion. They assert, that all the bodies of the solar system are continually impelled by a fluid which they call *ether,* which is moving in all places, and in all directions, or in circular vortices, and hurries along with it the planets and all heavy bodies. It would seem that the familiarity of motion produced by impulse, at least in those instances in which our own exertions are most employed, has induced philosophers to adopt such notions; perhaps, too, they are influenced by an obscure and indistinct notion affixed to the term action, as applied to changes in the material world, and which has given rise to an axiom, "that a body cannot act at a distance, or where it is not;" and thus have thought themselves obliged to look out for an immediate and contiguous agent in all those phenomena.

But the philosophers who profess to be most scrupulous in their adherence to the rules of philosophic discussion, deny the legitimacy of this pretended investigation of causes, saying that this doctrine is in direct opposition to the procedure of the mind in acquiring the knowledge of causes. Since the *fact* of impulse is not really *observed* in the celestial deflections, nor in the motions of heavy bodies, the law cannot be *inferred.* They say that it is not even necessary to show that the phenomena of the celestial motions are unlike the phenomena of impulse, although this can be done in the completest manner. It is enough that neither the fluid nor the impulse are observed; and therefore they are in the right when they assert, that there is inherent in, or accompanies all the bodies of the system, a power by which they deflect to one another. See Optics.

54
whilst impulse itself is never observed.

The debate is foreign to our present purpose, which is only to show how the observation and arrangement of phenomena terminates in the discovery of their causes, or the discovery of the powers or properties of natural substances.

This is a task of great difficulty, as it is of great importance. There are two chief causes of this difficulty.

1. In most of the spontaneous phenomena of nature there is a complication of many events, and some of them escape our observation. Attending only to the most obvious or remarkable, we conjoin these only in our imagination, and are apt to think these the concomitant events in nature, the proper indication of the cause, and the subjects of this philosophical relation, and to suppose that they are always conjoined by nature. Thus it was thought that there resided in a vibrating chord a power by which the sensation of sound was excited, or that a chord had a sounding quality. But it appears clearly from observation that there is an inconceivable number of events interposed between the vibration of the chord and the sensitive affection of our ear; and therefore, that sound is not the effect of the vibration of the chord, but of the very last event of this series: and this is com-

55
Causes of the difficulty of philosophical investigation.

pletely demonstrated by showing that the vibration and the sound are *not necessarily* connected, because they are not *always* connected, but require the interposition of air or of some other elastic body.

These observations show the necessity of the most accurate and minute observation of the phenomena, that none of those intermediate events may escape us, and we be thus exposed to the chance of imaginary connections between events which are really far asunder in the procedure of nature. As the study has improved, mistakes of this kind have been corrected; and philosophers are careful to make their trains of events under one name as short as possible. Thus, in medicine, a drug is no longer considered as a *specific* remedy for the disease which is sometimes cured when it has been used, but is denominated by its most immediate operation on the animal frame: it is no longer called a *febrifuge*, but a *sudorific*.

56 **Means of insuring success.**

2. When many natural powers combine their influence in a spontaneous phenomenon of nature, it is frequently very difficult to discover what part of the complicated effect is the effect of each; and to state those circumstances of similarity which are the foundation of a physical law, or entitle us to infer the agency of any natural power. The most likely method for insuring success in such cases is to get rid of this complication of event, by putting the subject into such a situation that the operation of all the known powers of nature shall be suspended, or so modified as we may perfectly understand *their* effects. We can thus appreciate the effects of such as we could neither modify nor suspend, or we can discover the existence of a new law, the operation of a new power.

This is called *making an experiment;* and is, of all, the most effectual way of advancing in the knowledge of nature, and has been called EXPERIMENTAL PHILOSOPHY.

57 **A seeming anomaly explained.**

It seems, however, at first sight, in direct opposition to the procedure of nature in forming general laws. These are formed by induction from multitudes of individual facts, and must be affirmed to no greater extent than the induction on which they are founded. Yet it is a matter of fact, a physical law of human thought, that one simple, clear, and unequivocal experiment, gives us the most complete confidence in the truth of a general conclusion from it to every similar case. Whence this anomaly? It is not an anomaly or contradiction of the general maxim of philosophical investigation, but the most refined application of it. There is no law more general than this, that "Nature is constant in all her operations." The judicious and simple form of our experiment insures se (we imagine) in the complete knowledge of all the circumstances of the event. Upon this supposition, and this alone, we consider the experiment as the faithful representative of every possible case of the conjunction. This will be more minutely considered afterwards.

58 **Theory or explanation of subordinate phenomena.**

The last branch of philosophic occupation is the explanation of subordinate phenomena. This is nothing more than the referring any particular phenomenon to that class in which it is included; or, in the language of philosophy, it is the pointing out the general law, or that general fact of which the phenomenon is a particular instance. Thus the feeling of the obligations of virtue is thought to be explained, when it is shown to be a particular case of that regard which every person has for his dearest interests. The rise of water in pumps is explained, when we show it to be a particular case of the pressure of fluids, or of the air. The general law under which we show it to be properly arranged is called the PRINCIPLE of the explanation, and the explanation itself is called the THEORY of the phenomenon. Thus Euler's explanation of the lunar irregularities is called a theory of the lunar motions on the principle of gravitation.

This may be done either in order to advance our own knowledge of nature, or to communicate it to others. If done with the first view, we must examine the phenomenon minutely, and endeavour to detect every circumstance in it, and thus discover all the known laws of nature which concur in its production; we then appreciate the operation of each according to the circumstances of its exertion; we then combine all these, and compare the result with the phenomenon. If they are similar, we have explained the phenomenon. We cannot give a better example than Franklin's explanation of the phenomena of thunder and lightning. See LIGHTNING, and ELECTRICITY *Index*.

If we explain a phenomenon from known principles, we proceed synthetically from the general law already established and *known* to exert its influence in the present instance. We state this influence both in kind and degree according to the circumstances of the case; and having combined them, we compare the result with the phenomenon, and show their agreement, and thus it is explained. Thus, because all the bodies of the solar system mutually gravitate, the moon gravitates to the sun as well as to the earth, and is continually, and in a certain determinate manner, deflected from that part which she would describe did she gravitate only to the earth. Her motion round the earth will be retarded during the first and third quarters of her orbit, and accelerated during the second and fourth. Her orbit and her period will be increased during our winter, and diminished during our summer. Her apogee will advance, and her nodes will recede; and the inclination of her orbit will be greatest when the nodes are in syzigee, and least when they are in quadrature. And all these variations will be in certain precise degrees. Then we show that all these things actually obtain the lunar motions, and they are considered as explained.

This summary account of the object and employment in all philosophical discussion is sufficient for pointing out its place in the circle of the sciences, and will serve to direct us to the proper methods of prosecuting it with success. Events are its object; and they are considered as connected with each other by causation, which may therefore be called the philosophical relation of things. The following may be adopted as the fundamental proposition on which all philosophical discussion proceeds, and under which every philosophical discussion or discovery may be arranged:

59 **Fundamental proposition of philosophical discussion.**

"*Every change that we observe in the state or condition of things* IS CONSIDERED BY US *as an effect, indicating the agency, characterising the kind, and determining the degree of its* INFERRED *cause.*"

As thus enounced, this proposition is evidently a physical law of human thought. It may be enounced as a necessary and independent truth, by saying, *every change in the state and condition of things* IS AN EFFECT, &c.

And accordingly it has been so enounced by Dr Reid*; and its title to this denomination has been abundantly supported by him. But we have no occasion to consider it as possessing this quality. We are speaking of philosophy, which is something contingent, depending on the existence and constitution of an intellectual being such as man; and, in conformity to the view which we have endeavoured to give of human knowledge in the subjects of philosophical relation, it is quite sufficient for our purpose that we maintain its title to the rank of an universal law of human thought. This will make it a first principle, even although it may not be a necessary truth.

All the proof necessary for this purpose is universality of fact; and we believe this to be without exception. We are not to expect that all mankind have made, or will ever make, a formal declaration of their opinion; but we may venture to say that all have made it, and continually do make it, virtually. What have the philosophers of all ages been employed about but the discovery of the causes of those changes that are incessantly going on? *Nil turpius physico* (says Cicero) *quam fieri sine causâ quidquam dicere.* Human curiosity has been directed to nothing so powerfully and so constantly as to this. Many absurd causes have been assigned for the phenomena of the universe; but no set of men have ever said that they happened without a cause. This is so repugnant to all our propensities and instincts, that even the atheistical sect, who, of all others, would have profited most by the doctrine, have never thought of advancing it. To avoid so shocking an absurdity, they have rather allowed that chance, that the concourse of atoms, are the causes of the beautiful arrangements of nature. The thoughtless vulgar are no less solicitous than the philosophers to discover the cause of things; and the poet expresses the natural and instinctive passion of all men, when he says,

Felix qui potuit rerum cognoscere causas.

And this anxiety is not to nourish, but to get rid of superstitious fears: for thus

—— *metus omnes, et inexorabile fatum*
Subjecit pedibus, strepitumque Acherontis avari.

Had men never speculated, their conduct alone gives sufficient evidence of the universality of the opinion. The whole conduct of man is regulated by it, nay, almost wholly proceeds upon it, in the most important matters, and where experience seems to leave us in doubt: and to act otherwise, as if any thing whatever happened without a cause, would be a declaration of insanity. Dr Reid has beautifully illustrated this truth, by observing, that even a child will laugh at you if you try to persuade him that the top, which he misses from the place where he left it, was taken away by nobody. You may persuade him that it was taken away by a fairy or a spirit; but he believes no more about this nobody, than the master of the house when *he* is told that nobody was the author of any piece of theft or mischief. What opinion would be formed, says Dr Reid, of the intellects of the juryman, on a trial for murder by persons unknown, who should say that the fractured skull, the watch and money gone, and other like circumstances, might possibly have no cause? he would be pronounced insane or corrupted.

60
Controverted by Mr Hume

We believe that Mr Hume is the first author who has ventured to call the truth of this opinion in question; and even *he* does it only in the way of mere possibility. He acknowledges the *generality* of the opinion; and he only objects to the foundation of this generality: and he objects to it merely because it does not quadrate with his theory of belief; and therefore it *may* happen that some men may have no such opinion. But it must be observed on this occasion, that the opinion of a philosopher is of no greater weight in a case like this than that of a ploughboy. If it be a first principle, directing the opinions and actions of all, it must operate on the minds of all. The philosopher is the only person who may chance to be without it: for it requires much labour, and long habits resolutely maintained, to warp our natural sentiments; and experience shows us that they may be warped if we are at sufficient pains. It is also worthy of remark, that this philosopher seems as much under the influence of this law as ordinary mortals. It is only when he is aware of its not tallying with his other doctrines that his scruples appear. Observe how he speaks when off his guard: "As to those impressions which arise from the senses, their ultimate cause is, in my opinion, perfectly inexplicable by human reason; and it will always be impossible to decide with certainty whether they arise immediately from the object, are produced by the creative power of the mind, or are derived from the Author of our being."

61
with great inconsistency.

Among these alternatives he never thought of their not being derived from any cause.

62
This proposition a first principle incapable of proof.

But it is not enough to show that this is a physical law of the human mind: we have assumed it as a first principle, the foundation of a whole science; therefore not included in or derived from any thing more general. Mr Hume's endeavours to prove that it is not a necessary truth, show with sufficient evidence that most attempts to derive it in the way of argument are *petitiones principii*; a thing very commonly met with in all attempts to prove first principles. It cannot be proved by induction of facts that every event has a cause, because induction always supposes an *observed fact* or event. Now in by far the greatest number of events the causes are unknown. Perhaps in no event whatever do we know the real cause, or that power or energy which, without any intervention, produces the effect. No man can say, that in the simplest event which he ever observed, he was fully apprised of every circumstance which concurred to its production. We suppose that no event in nature can be adduced more simple than the motion of a suspended glass ball when gently struck by another glass ball; and we imagine that most of our readers will say that he perfectly sees every thing which happens in this phenomenon. We believe, too, that most of our readers are of opinion that a body is never put in motion but by the impulse of another, except in the cases of animal motion; and that they are disposed to imagine that magnets put iron in motion, and that an electrified body moves another, by means of an interposed though invisible fluid somehow circulating round them. Now we must inform such readers, that unless the stroke has been very smart, so smart indeed as to shatter the glass balls, the motion of the suspended ball was produced without impulse: that is, the two balls were not in contact during the stroke; and the distance between them was not less than the

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* Essays on the Intellectual Powers of Man.

9000th part of an inch, and probably much greater. We must say farther, that it is not certain that even the most violent stroke, such as would shatter them to pieces, is enough to bring them into real contact. The proofs of this singular position are too long for this place; but the evidence will be sufficiently seen by consulting the article OPTICS.

Unless, therefore, our readers are willing to allow that the suspended ball was put in motion by a repulsive force inherent in one or both balls, they must acknowledge that they *do not* fully know all the circumstances of this so simple phenomenon, or all the train of events which happen in it; and therefore they are reduced to the necessity of *supposing*, although they do not see it, an intervening fluid or matter, by the immediate action of whose *adjoining* particles the motion is produced.

This being the case in the simplest phenomenon that we can pitch upon, what shall we say of the numberless multitudes which are incomparably more complex: Must we not acknowledge that the efficient causes, even in the vulgar sense of the word, the immediately preceding events, are unknown, because the conjunctions are not observed? and therefore it cannot be said that it is from experimental induction that this truth gains universal belief. Experience, so far from supporting it as a direct proof, seems rather the strongest argument against it; for we have no experiment of unquestionable authority but the narrow circle of our own power exerted on our thoughts and actions. And even here there are perhaps cases of change where we cannot say with certainty that we perceive the efficient cause.

Nothing seems to remain, therefore, but to allow that this physical law of human judgment is instinctive, a constituent of the human soul, a first principle; and incapable of any other proof than the appeal to the feelings of every man.

63
Causes not observed; but inferred from the phenomena which are the language of nature.

Simply to say, that every change is considered as an effect, is not giving the whole characters of this physical law. The cause is not always, perhaps never, *observed*, but is *inferred* from the phenomena. The inference is therefore in every instance dependant on the phenomenon. The phenomenon is to us the language of nature: It is therefore the sole indication of the cause and of its agency: it is therefore the indication of the very cause, and of no other. The observed change therefore characterises the cause and marks its kind. This is confirmed by every word of philosophical language, where, as has already been observed, the names of the inferred powers of nature are nothing but either abbreviated descriptions of the phenomena, or terms which are defined solely by such descriptions. In like manner, the phenomenon determines the cause in a *particular degree*, and in no other; and we have no immediate measure of the degree of the cause but the phenomenon itself. We take many measures of the cause, it is true; but on examination they will be found not to be immediate measures of the cause, but of the effect. Assuming gravitation as the cause of the planetary deviations from uniform rectilineal motion, we say that the gravitation of the moon is but $\frac{1}{3600}$th part of the gravitation of a stone thrown from the hand: but we say this only from observing that the deflection of the stone is 3600 times greater than the simultaneous deflection of the moon. In short, our whole knowledge of the cause is not only *founded* on our knowledge of the phenomenon, but *it is the same*. This will be found a remark of immense consequence in the prosecution of philosophical researches; and a strict attention to it will not only guard us against a thousand mistakes into which the reasoning pride of man would continually lead us, but will also enable us fully to detect many egregious and fatal blunders made in consequence of this philosophical vanity. Nothing can be more evident than that whenever we are puzzled, it would be folly to continue groping among those obscure beings called *causes*, when we have their prototypes, the phenomena themselves, in our hands.

Such is the account which may be given of philosophy, the study of the works of God, as related by causation. It is of vast extent, reaching from an atom to the glorious Author of the Universe, and contemplating the whole connected chain of intelligent, sensitive, and inanimate beings. The philosopher makes use of the descriptions and arrangements of the natural historian as of mighty use to himself in the beginning of his career, confiding in the uniformity of nature, and expecting that similarity in the quiescent properties of things will be accompanied by some resemblances in those more important properties which constitute their mutual dependencies, linking them together in a great and endlessly ramified chain of events.

We have endeavoured to ascertain with precision the peculiar province of philosophy, both by means of its object and its mode of procedure. After this it will not require many words to point out the methods for prosecuting the study with expedition and with success. The rules of philosophizing, which Newton premises to his account of the planetary motions, which he so scrupulously followed, and with a success which gives them great authority, are all in strict conformity to the view we have now given of the subject.

64
The chief rule of philosophising explained.

The chief rule is, that similar causes are to be assigned to similar phenomena. This is indeed the source of all our knowledge of connected nature; and without it the universe would only present to us an incomprehensible chaos. It is by no means, however, necessary to enjoin this as a maxim for our procedure: it is an instinctive propensity of the human mind. It is absolutely necessary, on the contrary, to caution us in the application of this propensity. We must be extremely confident in the certainty of the resemblance before we venture to make any inference. We are prone to reason from analogy: the very employment is agreeable; and we are ever disposed to embrace opportunities of engaging in it. For this reason we are satisfied with very slight resemblances, and eagerly run over the consequences, as if the resemblance were complete; and our researches frequently terminate in falsehood.

This propensity to analogical reasoning is aided by another equally strong, and equally useful, when properly directed; we mean the propensity to form general laws: it is in fact a propensity to discover *causes*, which is equivalent to the establishing of general laws. It appears in another form, and is called a love of or taste for simplicity; and this is encouraged or justified as agreeable to the uniformity and simplicity of nature. "Natura semper sibi similis et consona," says Newton; "Frustra fit per plura, quo fieri potest per pauciora," says another. The beautiful, the wise economy of nature, are phrases in every body's mouth; and Newton enjoins us to adopt no more causes than are sufficient to explain the phenomena. All this is very well, and is true in its own degree; but it is too frequently the subterfuge of human vanity and self-love. This inordinate admiration of the economy and simplicity of nature is generally conjoined with a manifest love of system, and with the actual production of some new system, where from one general principle some extensive theory or explanation is deduced and offered to the world. The author sees *a sort* of resemblance between a certain series of phenomena and the consequences of some principle, and thinks the principle adequate to their explanation. Then, on the authority of the acknowledged simplicity of nature, he roundly excludes all other principles of explanation; because, says he, this principle is sufficient, "et frustra fit per plura," &c. We could point out many instances of this kind in the writings of perhaps the first mathematician and the poorest philosopher of this century; where extensive theories are thus cavalierly exhibited, which a few years examination have shown to be nothing but analogies, indistinctly observed, and, what is worse, inaccurately applied.

65
A true cause explained.

To regulate these hazardous propensities, and keep philosophers in the right path, Newton inculcates another rule, or rather gives a modification of this injunction of simplicity. He enjoins that no cause shall be admitted but what is real. His words are, that *no causes shall be admitted but such as are true, and sufficient to account for the phenomena.* We apprehend that the meaning of this rule has been mistaken by many philosophers, who imagine that by *true* he means causes which really exist in nature, and are not mere creatures of the imagination. We have met with some who would boggle at the doctrines of Aristotle respecting the planetary motions, viz. that they are carried along by conducting intelligent minds, because we know of *none such* in the universe; and who would nevertheless think the doctrine of the Cartesian vortices deserving of at least an examination, because we see such vortices exist, and produce effects which have some resemblance to the planetary motions, and have justly rejected them, *solely* because this resemblance has been very imperfect. We apprehend Newton's meaning by these words is, that no cause of any event shall be admitted, or even considered, which we *do not know* to be actually concurring or exerting some influence *in that very event.* If this be his meaning, he would reject the Cartesian vortices, and the conducting spirits of Aristotle, for one and the same reason; not because they were not adequate to the explanation, nor because such causes do not exist in nature, but because we did not *see them* anyhow concerned in the phenomenon under consideration. We neither see a spirit nor a vortex, and therefore need not trouble ourselves with enquiring what effects they would produce. Now we know that this was his very conduct, and what has distinguished him from all philosophers who preceded him, though many, by following his example, have also been rewarded by similar success. This has procured to Newton the character of the *modest* philosopher; and modest his procedure may, for distinction's sake, be called, because the contrary procedure of others did not originate so much from ignorance as from vanity. Newton's conductor in this was not modesty, but sagacity, prudence, caution, and to say it purely, it was sound judgment.

For the bonds of nature, the supposed philosophical causes are not *observed;* they are *inferred* from the phenomena. When two substances are observed, and only when they are observed, to be connected in any series of events, we *infer* that they are connected by a natural power: but when one of the substances is not seen, but fancied, no law of human thought produces any inference whatever. For this reason alone Newton stopped short at the last FACT which he could discover in the solar system, that all bodies were deflected to all other bodies, according to certain regulations of distance and quantity of matter. When told that he had done nothing in philosophy, that he had discovered no cause, and that to merit any praise he must show how this deflection was produced;—he said that he knew no more than he had told them; that he saw nothing causing this deflection; and was contented with having discovered it so exactly, that a good mathematician could now make tables of the planetary motions as accurate as he pleased, and with hoping in a few years to have every purpose of navigation and of philosophical curiosity completely answered; and he was not disappointed. And when philosophers on all sides were contriving hypothetical fluids and vortices which would produce these deflections, he contented himself with showing the total inconsistency of these explanations with the mechanical principles acknowledged by their authors; showing that they had transgressed both parts of his rule, their causes neither being real nor sufficient for explaining the phenomena. A cause is sufficient for explaining a phenomenon only when its legitimate consequences are perfectly agreeable to these phenomena.

Newton's discoveries remain without any diminution or change: no philosopher has yet advanced a step further.

66
This doctrine founded in reason.

But let not the authority, or even the success, of Newton be our guide. Is his rule founded in reason? It surely is. For if philosophy be the only interpretation of nature's language, the inference of causes from the phenomena, a fancied or hypothetical phenomenon can produce nothing but a fanciful cause, and can make no addition to our knowledge of real nature.

67
Danger of hypotheses.

All hypotheses therefore must be banished from philosophical discussion as frivolous and useless, administering to vanity alone. As the explanation of any appearance is nothing but the pointing out the general fact, of which this is a particular instance, a hypothesis can give no explanation: knowing nothing of cause and effect but the conjunction of two events, we see nothing of causation where one of the events is hypothetical. Although all the legitimate consequences of a hypothetical principle should be perfectly similar to the phenomenon, it is extremely dangerous to assume this principle as the real cause. It is illogical to make use of the economy of nature as an argument for the truth of any hypothesis: for if true, it is a physical truth, a matter of fact, and true only to the extent in which it is observed, and we are not entitled to say that it is so one step farther; therefore not in *this* case *till it be observed.* But the proposition that nature is so economical is false; and it is astonishing that it has been so lazily acquiesced in by the *readers* of hypotheses: for it is not the *authors* who are deceived by it, they are generally led by their own vanity. Nothing is more observable than the prodigious variety of nature. That the same phenomena may be produced by different means is well known to the astronomers,

nomers, who must all grant, that the appearances of motion will be precisely the same whether the earth moves round the sun like the other planets, or whether the sun with his attendant planets moves round the earth; and that the demonstration of the first opinion is had from a fact totally unconnected with all the deflections or even with their causes: for it may be asserted, that Dr Bradley's discovery of the aberration of the fixed stars, in consequence of the progressive motion of light, was the first thing which put the Copernican system beyond question; and even this is still capable of being explained in another way. The Author of Nature seems to delight in variety; and there cannot be named a single purpose on which the most inconceivable fertility in resource is not observed. It is the most delightful occupation of the curious mind and the sensible heart to contemplate the various contrivances of nature in accomplishing similar ends.

As a principle therefore on which to found any maxim of philosophical procedure, this is not only injudicious, because imprudent and *apt* to mislead, but as false, and almost sure to mislead. In conformity to this observation, it must be added, that nothing has done so much harm in philosophy as the introduction of hypotheses.

Authors have commonly been satisfied with very slight resemblances, and readers are easily misled by the appearances of reasoning which these resemblances have countenanced. The ancients, and above all Aristotle, were much given to this mode of explanation, and have filled philosophy with absurdities. The slightest resemblances were with them sufficient foundations of theories. It has been by very slow degrees that men have learned caution in this respect; and we are sorry to say that we are not yet cured of the disease of hypothetical systematizing, and to see attempts made by ingenious men to bring the frivolous theories of antiquity again into credit. Nay, modern philosophers even of the greatest name are by no means exempted from the reproach of hypothetical theories. Their writings abound in ethers, nervous fluids, animal spirits, vortices, vibrations, and other invisible agents. We may affirm that all these attempts may be shown to be either unintelligible, fruitless, or false. Either the hypothesis has been such that no consequence can be distinctly drawn from it, on account of its obscurity and total want of resemblance to any thing we know; or the just and legitimate consequences of the hypothesis are inconsistent with the phenomena (N). This is remarkably the case in the hypotheses which have been introduced for the explanation of the mechanical phenomena of the universe. These can be examined by accurate science, and the consequences compared without any mistake; and nothing else but a perfect agreement should induce us even to listen to any hypothesis watever.

It may here be asked, Whether, in the case of the most perfect agreement, after the most extensive comparison, the hypothesis should be admitted? We believe that this must be left to the feelings of the mind. When the belief is irresistible, we can reason no more. But as there is no impossibility of as perfect an agreement with some other hypothesis, it is evident that it does not convey an irrefragable title to our hypothesis. It is said, that such an agreement authorises the reception of the hypothetical theory in the same manner as we *must* admit that to be the *true* cypher of a letter which will make perfect sense of it. But this is not true: in decyphering a letter we know the sounds which *must* be represented by the characters, and that they are really the constituents of speech: but in hypothetical explanations the first principle is not known to exist; nay, it is possible to make two cyphers, each of which shall give a meaning to the letter. Instances of this are to be seen in treatises on the art of decyphering; and there has been lately discovered a national character (the *ogam* discovered in Ireland) which has this property.

We conclude our criticism on hypothetical explanations with this observation, that it is *impossible* that they can give any addition of knowledge. In every hypothesis we thrust in an intermediate event between the phenomenon and some general law; and this event is not seen, but supposed. Therefore, according to the true maxims of philosophical investigation, we give no explanation; for we are not by this means enabled to assign the general law in which this particular phenomenon is included: nay, the hypothesis makes no addition to our list of general laws; for our hypotheses must be *selected*, in order to tally with all the phenomena. The hypothesis therefore is understood only *by* and *in* the phenomena; and it must not be made more general than the phenomena themselves. The hypothesis gives no generalisation of facts. Its very application is founded on a great coincidence of facts; and the hypothetical fact is thrust in between two which we really observe to be united by nature. The applicability therefore of the hypothesis

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(N) It has often been matter of amusement to us to examine the hypothetical theories of ingenious men, and to observe the power of nature even when we are transgressing her commands, *Naturam expellat furca, tamen usque revertitur*. The hypothesis of an ingenious man is framed in perfect conformity to nature's dictates? for you will find that the hypothetical cause is touched and retouched, like the first sitting of a picture, till it is made to resemble the phenomena, and the cause is still inferred, nay explained, in spite of all his ingenuity, from the phenomenon; and then, instead of desiring the spectators to pay him his due praise, by saying that the picture is like the man, he insists that they shall say, what gives him no credit, that the man is like the picture. But alas! this is seldom the case: The picture is generally an anamorphosis, unlike any thing extant in nature, and having parts totally incongruous. We have seen such pictures, where a wood is standing on the sea, and an eye is on the end of an elephant's trunk; and yet when this was viewed through a proper glass, the wood became an eyebrow to the eye, and the proboscis was a very pretty ringlet of hair. We beg indulgence for this piece of levity, because it is a most apposite illustration of a hypothetical theory. The resemblance between the principle and phenomenon is true only in detached unconnected scraps, and the principle itself is an incongruous patchwork. But by a perversion of the rules of logic, all these inconsistencies are put out of view, and the explanation is something like the phenomenon.

hypothesis is not more extensive than the similarity of facts which we observe, and the hypothetical law is not more general than the observed law. Let us then throw away entirely the hypothetical law, and insert the observed one in our list of general laws: it will be in different language from the hypothetical law, but it will express the same facts in nature.

68 On what occasions they may be useful. It is in experimental philosophy alone that hypotheses can have any just claim to admission; and here they are not admitted as explanations, but as conjectures serving to direct our line of experiments.

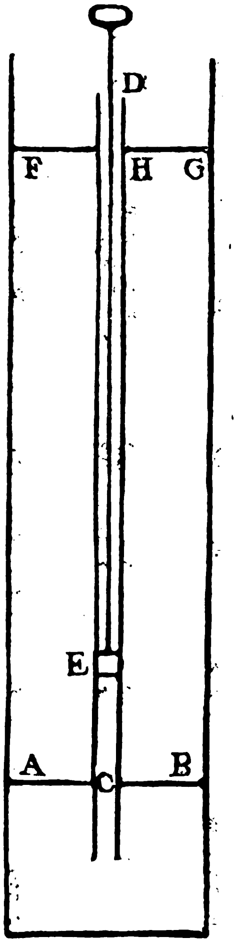
Effects only appear; and by their appearance, and the previous information of experience, causes are immediately ascertained by the perfect similarity of the whole train of events to other trains formerly observed: Or they are suggested by more imperfect resemblances of the phenomena; and these suggestions are made with stronger or fainter evidence, according as the resemblance is more or less perfect. These suggestions do not amount to a confidential inference, and only raise a conjecture. Wishing to verify or overturn this conjecture, we have recourse to experiment; and we put the subject under consideration in such a situation, that we can say what will be the effect of the conjectural cause if real. If this tallies with the appearance, our conjecture has more probability of truth, and we vary the situation, which will produce a new set of effects of the conjectured cause, and so on. It is evident that the probability of our conjecture will increase with the increase of the conformity of the legitimate effects of the supposed cause with the phenomena, and that it will be entirely destroyed by *one* disagreement. In this way conjectures have their great use, and are the ordinary means by which experimental philosophy is improved. But conjectural systems are worse than nonsense, filling the mind with false notions of nature, and generally leading us into a course of improper conduct when they become principles of action. This is acknowledged even by the abbettors of hypothetical systems themselves when employed in overturning those of their predecessors, and establishing their own: witness the successive maintainers of the many hypothetical systems in medicine, which have had their short-lived course within these two last centuries.

Let every person therefore who calls himself a philosopher resolutely determine to reject all temptations to this kind of system-making, and let him never consider any composition of this kind as any thing better than the amusement of an idle hour.

69 True mode of philosophical procedure. After these observations, it cannot require much discussion to mark the mode of procedure which will insure progress in all philosophical investigations.

The sphere of our intuitive knowledge is very limited; and we must be indebted for the greatest part of our intellectual attainments to our rational powers, and it must be deductive. In the spontaneous phenomena of nature, whether of mind or body, it seldom happens that the energy of that natural power, which is the principle of explanation, is so immediately connected with the phenomenon that we see the connection at once. Its exertions are frequently concealed, and in all cases modified, by the joint exertions of other natural powers: the particular exertion of each must be considered apart, and their mutual connection traced out. It is only in this way that we can discover the perhaps long train of intermediate operations, and also see in what manner and degree the real principle of explanation concurs in the ostensible process of nature.

In all such cases it is evident that our investigation (and investigation it most strictly is) must proceed by steps, conducted by the sure hand of logical method. To take an instance from the material world, let us listen to Galileo while he is teaching his friends the cause of the rise of water in a pump. He says that it is owing to the pressure of the air. This is his principle; and he announces it in all its extent. All matter, says he, is heavy, and in particular air is heavy. He then points out the connection of this general principle with the phenomenon. Air being heavy, it must be supported; it must lie and press on what supports it; it must press on the surface AB of the water in the cistern surrounding the pipe CD of the pump; and also on the water C within this pipe. He then takes notice of another general principle which exerts its subordinate influence in this process. Water is a fluid; a fluid is a body whose parts yield to the smallest impression; and, by yielding, are easily moved among themselves; and no little parcel of the fluid can remain at rest unless it be equally pressed in every direction, but will recede from that side where it sustains the greatest pressure. In consequence of this fluidity, *known* to be a property of water, if any part of it is pressed, the pressure is propagated through the whole; and if not resisted on every side, the water will move to that side where the propagated pressure is not resisted. All these subordinate or collateral propositions are supposed to be previously demonstrated or allowed. Water therefore must yield to the pressure of the air unless pressed by it on every side, and must move to that side where it is not withheld by some opposite pressure. He then proceeds to show, from the structure of the pump, that there is no opposing pressure on the water in the inside of the pump. "For (says he) suppose the piston thrust down till it touches the surface of the water in the pipe; suppose the piston now drawn up by a power sufficient to lift it, and all the air incumbent on it; and suppose it drawn up a foot or fathom—there remains nothing now (says he) that I know of, to press on the surface of the water. In short (says he), gentlemen, it appears to me, that the water in the pump is in the same situation that it would be in were there no air at all, but water poured into the cistern to a height AF: such, that the column of water FABG presses on the surface AB as much as the air does. Now in this case we know that the water at C is pressed upwards



wards with a force equal to the weight of a column of water, having the section of the pipe for its base and CH for its height. The water below C therefore will be pressed up into the pipe CD, and will rise to G, so that it is on a level with the external water FG; that is, it will rise to H. This is a necessary consequence of the weight and pressure of the incumbent column FABG, and the fluidity of the water in the cistern. Consequences perfectly similar must necessarily follow from the weight and pressure of the air; and therefore on drawing up the piston from the surface C of the water, with which it was in contact, the water must follow it till it attain that height which will make its own weight a balance for the pressure of the circumambient air. Accordingly, gentlemen, the Italian plumbers inform me, that a pump will not raise water quite fifty palms; and from their information I conclude, that a pillar of water fifty palms high is somewhat heavier than a pillar of air of the same base, and reaching to the top of the atmosphere."

70 The synthetic method.

Thus is the phenomenon explained. The rise of the water in the pump is shown to be a particular case of the general fact in hydrostatics, that fluids in communicating vessels will stand at heights which are inversely as their densities, or that columns of equal weights are in equilibrio.

This way of proceeding is called arguing *à priori*, the synthetic method. It is founded on just principles; and the great progress which we have made in the mathematical sciences by this mode of reasoning shows to what length it may be carried with irresistible evidence. It has long been considered as the only inlet to true knowledge; and nothing was allowed to be known with certainty which could not be demonstrated in this way to be true. Accordingly logic, or the art of reasoning, which was also called the art of discovering truth, was nothing but a set of rules for successfully conducting this mode of argument.

Under the direction of this infallible guide, it is not surely unreasonable to expect that philosophy has made sure progress towards perfection; and as we know that the brightest geniuses of Athens and of Rome were for ages solely occupied in philosophical researches in every path of human knowledge, it is equally reasonable to suppose that the progress has not only been sure but great. We have seen that the explanation of an appearance in nature is nothing but the arrangement of it into that general class in which it is comprehended. The class has its distinguishing mark, which, when it is found in the phenomenon under consideration, fixes it in its class, there to remain for ever an addition to our stock of knowledge. Nothing can be lost any other way but by forgetting it; and the doctrines of philosophers must be stable like the laws of nature.

We have seen, however, that the very reverse of all this is the case; that philosophy has but very lately emerged from worse than total darkness and ignorance; that what passed under the name of philosophy was nothing but systems of errors (if systems they could be called), which were termed doctrines, delivered with the most imposing apparatus of logical demonstration, but belied in almost every instance by experience, and affording us no assistance in the application of the powers of nature to the purposes of life. Nor will this excite much wonder in the mind of the enlightened reader of the present day, who reflects on the use that in this dialectic process was made of the *categories*, and the method in which those categories were formed. From first principles so vague in themselves, and so gratuitously assumed, ingenious men might deduce many different conclusions all equally erroneous: and that this was actually done, no surer evidence can be given, than that hardly a lifetime elapsed in which the whole system of doctrines which had captivated the minds of the most penetrating, have been oftener than once exploded and overturned by another system, which flourished for a while, and then was supplanted by a third which shared the same fate. Here was an infallible proof of their error, for instability is incompatible with truth.

It is allowed by all that this has been the case in those branches of study at least which contemplate the philosophical relations of the material world, in astronomy, in mechanical philosophy, in chemistry, in physiology, in medicine, in agriculture. It is also acknowledged, that in the course of less than two centuries back we have acquired much knowledge on these very subjects, call it philosophy, or by what name you will, so much more conformable to the natural course of things, that the deductions made from it by the same rules of the synthetic method are more conformable to fact, and therefore better fitted to direct our conduct and improve our powers. It is also certain that these bodies of doctrine which go by the name of philosophical systems, have much more stability than in ancient times; and though sometimes in part superseded, are seldom or never wholly exploded.

This cannot perhaps be affirmed with equal confidence with respect to these speculations which have our intellect or propensities for their object: and we have not perhaps attained such a representation of human nature as will bear comparison with the original; nor will the legitimate deductions from such doctrines be of much more service to us for directing our conduct than those of ancient times: and while we observe this difference between these two general classes of speculations, we may remark, that it is conjoined with a difference in the manner of conducting the study. We have proceeded in the old Aristotelian method when investigating the nature of mind; but we see the material philosophers running about, passing much of their time away from books in the shop of the artizan, or in the open fields engaged in observation, labouring with their hands, and busy with experiments. But the speculatist on the intellect and the active powers of the human soul seems unwilling to be indebted to any thing but his own ingenuity, and his labours are confined to the closet. In the first class, we have met with something like success, and we have improved many arts: in the other, it is to be feared that we are not much wiser, or better, or happier, for all our philosophic attainments.

71 No inlet to truth.

Here, therefore, must surely have been some great, some fatal mistake. There has indeed been a material defect in our mode of procedure, in the employment of this method of reasoning as an inlet to truth. The fact is, that philosophers have totally mistaken the road of discovery, and have pretended to set out in their investigation from the very point where this journey should have terminated.

The Aristotelian logic, the syllogistic art, that art so much boasted of as the only inlet to true knowledge, the

72
But the art of communicating knowledge.

the only means of discovery, is in direct opposition to the ordinary procedure of nature, by which we every day, and in every action of our lives, acquire knowledge and discover truth. It is not the art of discovering truth, it is the art of communicating knowledge, and of detecting error: it is nothing more than the application of this maxim, 'whatever is true of a whole class of objects, is true of each individual of that class.' This is not a just account of the art of discovering truth, nor is it a complete account of the art of reasoning. Reasoning is the producing belief; and whatever mode of argumentation invariably and irresistibly produces belief, is reasoning. The ancient logic supposes that all the first principles are already known, and that nothing is wanted but the application of them to particular facts. But were this true, the application of them, as we have already observed, can hardly be called a discovery; but it is not true; and the fact is, that the first principles are generally the chief objects of our research, and that they have come into view only now and then as it were by accident, and never by the labour of the logician. He indeed can tell us whether we have been mistaken; for if our general principle be true, it must influence *every* particular case. If, therefore, it be false in any one of these, it is not a true principle. And it is here that we discover the source of that fluctuation which is so much complained of in philosophy. The authors of systems give a set of consecutive propositions logically deduced from a first principle, which has been hastily adopted, and has no foundation in nature. This does not hinder the amusement of framing a system from it, nor this system from pleasing by its symmetry; and it takes a run: but when some officious follower thinks of making some use of it, which requires the comparison with experience and observation, they are found totally unlike, and the whole fabric must be abandoned as unsound: and thus the successive systems were continually pushing out their predecessors, and presently met with the same treatment.

How was this to be remedied? The ratiocination was seldom egregiously wrong; the syllogistic art had ere now attained a degree of perfection which left little room for improvement, and was so familiarly understood by the philosophical practitioners, that they seldom committed any great blunders. Must we examine the first principles? This was a task quite new in science; and there were hardly any rules in the received systems of logic to direct us to the successful performance of it. Aristotle, the sagacious inventor of those rules, had not totally omitted it; but in the fervour of philosophic speculation he had made little use of them. His fertile genius never was at a loss for first principles, which answered the purpose of verbal disquisition without much risk of being belied on account of its dissimilitude to nature; for there was frequently no prototype with which his systematic doctrine could be compared. His enthusiastic followers found abundant amusement in following his example; and philosophy, no longer in the hands of men acquainted with the world, conversant in the great book of nature, was now confined almost entirely to recluse monks, equally ignorant of men and of things. But curiosity was awakened, and the men of genius were fretted as well as disgusted with the disquisitions of the schools, which one moment raised expectations by the symmetry of composition, and the next moment blasted them by their inconsistency with experience.

They saw that the best way was to begin *de novo*, to throw away the first principles altogether, without exception or examination, and endeavour to find out new ones, which should stand the test of logic; that is, should in every case be agreeable to fact.

73
The method of induction pointed out by nature.

Philosophers began to reflect, that under the unnoticed tuition of kind nature we have acquired much useful knowledge. It is therefore highly probable, that her method is the most proper for acquiring knowledge, and that by imitating her manner we shall have the like success. We are too apt to slight the occupations of children, whom we may observe continually busy turning every thing over and over, putting them into every situation, and at every distance. We excuse it, saying that it is an innocent amusement; but we should say with an ingenious philosopher (Dr Reid), that they are most seriously and rationally employed: they are acquiring the habits of observation; and by merely indulging an undetermined curiosity, they are making themselves acquainted with surrounding objects: they are struck by similitudes, and amused with mere classification. If some new effect occurs from any of their little plays, they are eager to repeat it. When a child has for the first time tumbled a spoon from the table, and is pleased with its jingling noise on the floor, if another lie within its reach, it is sure to share the same fate. If the child be indulged in this diversion, it will repeat it with greediness that deserves our attention. The very first eager repetition shows a confidence in the constancy of natural operations, which we can hardly ascribe wholly to experience; and its keenness to repeat the experiment, shows the interest which it takes in the exercise of this most useful propensity. It is beginning the study of nature; and its occupation is the same with that of a Newton computing the motions of the moon by his sublime theory, and comparing his calculus with observation. The child and the philosopher are equally employed in the contemplation of a similarity of event, and are anxious that this similarity shall return. The child, it is true, thinks not of this abstract object of contemplation, but throws down the spoon again to have the pleasure of hearing it jingle. The philosopher suspects that the conjunction of events is the consequence of a general law of nature, and tries an experiment where this conjunction recurs. The child is happy, and eager to enjoy a pleasure which to us appears highly frivolous; but it has the same foundation with the pleasure of the philosopher, who rejoices in the success of his experiment: and the fact, formerly a trifle to both, now acquires importance. Both go on repeating the experiment, till the fact ceases to be a novelty to either: the child is satisfied, and the philosopher has now established a new law of nature.

Such (says this amiable philosopher) is the education of kind nature, who from the beginning to the end of our lives makes the play of her scholars their most instructive lessons, and has implanted in our mind the curiosity and the inductive propensity by which we are enabled and disposed to learn them. The exercise of this inductive principle, by which nature prompts us to infer general laws from the observation of particular facts, gives us a species of logic new in the schools, but old as human nature. It is certainly a method of discovery; for by these means general principles, formerly unknown, have come into view.

74 Is a just logic. It is a just and rational logic; for it is founded on, and indeed is only the habitual application of, this maxim, "That whatever is true with respect to every individual of a class of events, is true of the whole class." This is just the inverse of the maxim on which the Aristotelian logic wholly proceeds, and is of equal authority in the court of reason. Indeed the expression of the general law is only the abbreviated expression of every particular instance.

This new logic, therefore, or the logic of induction, must not be considered as subordinate to the old, or founded on it. See LOGIC, Part III. chap. 5. In fact, the use and legitimacy of the Aristotelian logic is founded on the inductive,

All animals are mortal;
All men are animals; therefore
All men are mortal.

This is no argument to any person who chooses to deny the mortality of man; even although he acknowledges his animal nature, he will deny the major proposition.

It is beside our purpose to show, how a point so general, so congenial to man, and so familiar, remained so long unnoticed, although the disquisition is curious and satisfactory. It was not till within these two centuries that the increasing demand for practical knowledge, particularly in the arts, made inquisitive men see how useless and insufficient was the learning of the schools in any road of investigation which was connected with life and business; and observe that society had received useful information chiefly from persons actually engaged in the arts which the speculists were endeavouring to illustrate; and that this knowledge consisted chiefly of experiments and observations, the only contributions which their authors could make to science.

The *Novum Organum* of Bacon, which points out the true method of forming a body of real and useful knowledge, namely, the study of nature in the way of description, observation, and experiment, is undoubtedly the noblest present that science ever received. It may be considered as the grammar of nature's language, and is a counter-part to the logic of Aristotle; not exploding it, but making it effectual.

75 Its chief rule. As the logic of Aristotle had its rules, so has the Baconian or inductive; and this work, the *Novum Organum Scientiarum*, contains them all. The chief rule, and indeed the rule from which all the rest are but derivations, is, that "the induction of particulars must be carried as far as the general affirmation which is deduced from them." 76 for discovering general principles. If this be not attended to, the mind of man, which from his earliest years shows great eagerness in searching for first principles, will frequently ascribe to the operation of a general principle events which are merely accidental. Hence the popular belief in omens, palmistry, and all kinds of fortune-telling.

This rule must evidently give a new turn to the whole track of philosophical investigation. In order to discover first principles, we must make extensive and accurate observations, so as to have copious inductions of facts, that we may not be deceived as to the extent of the principle inferred from them. We must extend our acquaintance with the phenomena, paying a minute attention to what is going on all around us; and we must study nature, not shut up in our closet drawing the picture from our own fancy, but in the world, copying our lines from her own features.

To delineate human nature, we must see how men act. To give the philosophy of the material world, we must notice its phenomena.

This method of studying nature has been prosecuted during these two last centuries with great eagerness and success. Philosophers have been busy in making accurate observations of facts, and copious collections of them. Men of genius have discovered points of resemblance, from which they have been able to infer many general powers both of mind and body; and resemblances among these have suggested powers still more general.

By these efforts investigation became familiar; philosophers studied the rules of the art, and became more expert; hypotheses were banished, and nothing was admitted as a principle which was not inferred from the most copious induction. Conclusions from such principles became every day more conformable to experience. Mistakes sometimes happened; but recourse being had to more accurate observation or more copious induction, the mistakes were corrected. 77 and rectifying mistakes. In the present study of nature, our steps are more slow, and hesitating and painful; our conclusions are more limited and modest, but our discoveries are more certain and progressive, and the results are more applicable to the purposes of life. This pre-eminence of modern philosophy over the ancient is seen in every path of inquiry. It was first remarkable in the study of the material world; and there it still continues to be most conspicuous. But it is no less to be seen in the later performances of philosophers in metaphysics, pneumatology, and ethics, where the mode of investigation by analysis and experiment has been greatly adopted; and we may add, that it is this juster view of the employment which has restored philosophers to the world, to society. They are no longer to be found only in the academies of the sophists and the cloisters of a convent, but in the discharge of public and private duty. A philosophic genius is a genius for observation as well as reflection, and he says, *Homo sum, humani à me nihil alienum puto*.

78 Estimate of the philosophic character. After saying so much on the nature of the employment, and the mode of procedure, it requires no deep penetration to perceive the value of the philosophical character. If there is a propensity in the human mind which distinguishes us from the inferior orders of sentient beings, without the least circumstance of interference, a propensity which alone may be taken for the characteristic of the species, and of which no trace is to be found in any other, it is disinterested intellectual curiosity, a love of discovery for its own sake, independent of all its advantages.

We think highly (and with great justice do we think so) of our rational powers; but we may carry this too far, as we do every ground of self-estimation. To every man who enjoys the cheering thought of living under the care of a wise Creator, this boasted prerogative will be viewed with more modesty and diffidence; and He has given us evident marks of the rank in which He esteems the rational powers of man. In no case that is of essential importance, of indispensable necessity, not only ly to our wellbeing but to our very existence, has He left man to the care of his reason alone; for in the first instance, He has given us reason

To guide the helm, while passion blows the gale.

79
We should think modestly of our rational powers.

God has not trusted either the preservation of the individual or the continuance of the race to man's notions of the importance of the task, but has committed them to the surer guards of hunger and of sexual desire. In like manner, He has not left the improvement of his noblest work, the intellectual powers of the soul of man, to his own notions how important it is to his comfort that he be thoroughly acquainted with the objects around him. No: He has committed this also to the sure hand of curiosity: and He has made this so strong in a few superior souls, whom He has appointed to give light and knowledge to the whole species, as to abstract them from all other pursuits, and to engage them in intellectual research with an ardour which no attainment can ever quench, but, on the contrary, inflames it the more by every draught of knowledge.

80
Importance of our instinctive principles.

——————— But what need words
To paint its power? For this the daring youth
Breaks from his weeping mother's folding arms
In foreign climes to rove. The pensive sage,
Heedless of sleep, or midnight's hurtful vapour,
Hangs o'er the sickly taper.—Hence the scorn
Of all familiar prospects, though beheld
With transport once. Hence the attentive gaze
Of young astonishment.
Such is the bounteous providence of Heaven,
In every breast implanting the desire
Of objects new and strange, to urge us on
With unremitting labour to attain
The sacred stores that wait the rip'ning soul
In Truth's exhaustless bosom. *Aikenside.*

81
Our disposition to refinement.

But human life is not a situation of continual necessity; this would ill suit the plans of its beneficent Author: and it is from induction of phenomena totally opposite to this, and from such induction alone, that we have ever thought of a wise Creator. His wisdom appears only in His beneficence. Human life is a scene filled with enjoyment; and the soul of man is stored with propensities and powers which have *pleasure, in direct terms*, for their object. Another striking distinction of our nature is a continual disposition to refinement, of which few traces are to be found in the actions of other animals. There is hardly a gift of nature so grateful in itself as to please the freakish mind of man, till he has moulded it to his fancy. Not contented with food, with raiment, and with shelter, he must have nice cookery, ornamental dress, and elegant houses. He hunts when he is not hungry, and he refines sexual appetite into a most elegant passion. In like manner he has improved this anxious desire of the knowledge of the objects around him, so as to derive from them the means of subsistence and comfort, into the most elegant and pleasing of all gratifications, the accumulation of intellectual knowledge, independent of all consideration of its advantages. And as every man has a title to the enjoyment of such pleasures as he can attain without injuring his neighbour; so it is allowable to such as have got the means of intellectual improvement, without relinquishing the indispensable social duties, to push this advantage as far as it will go: and, in all ages and countries, it has been considered as forming the greatest distinction between men of easy fortune and the poor, who must earn their subsistence by the sweat of their brow. The plebeian must learn to work, the gentleman must learn to think; and nothing can be a surer mark of groveling soul than for a man of fortune to have an uncultivated mind.

82
Ought to be cherished as far as it is subservient to the duties of life.

Let us then cherish to the utmost this distinguishing propensity of the human soul: but let us do even this like philosophers. Let us cultivate it as it is: as the handmaid to the arts and duties of life; as the guide to something yet more excellent. A character is not to be estimated from what the person knows, but from what he can perform. The accumulation of intellectual knowledge is too apt to create an inordinate appetite for it: and the man habituated to speculation is, like the miser, too apt to place that pleasure in the mere *possession*, which he ought to look for only or chiefly in the *judicious use* of his favourite object. Like the miser, too, his habits of hoarding up generally unfit him for the very enjoyment which at setting out he proposed to himself. Seldom do we find the man, who has devoted his life to scientific pursuits for their own sake, possessed of that superiority of mind which the active employ to good purpose in times of perplexity; and much seldomer do we find him possessed of that promptitude of apprehension, and that decision of purpose, which are necessary for passing through the difficult scenes of human life.

83
Limits of our knowledge.

But we may use the good things of this life without abusing them; and by moderation here, as in all other pursuits, derive those solid advantages which philosophy is able to bestow. And these advantages are great. To enumerate and describe them would be to write a great volume. We may just take notice of one, which is an obvious consequence of that strict and simple view which we have given of the subject; and this is a modest opinion of our attainments. Appearances are all that we know; causes are for ever hid from our view; the powers of our nature do not lead us so far. Let us therefore, without hesitation, relinquish all pursuits which have such things as ultimate principles for *objects of examination.* Let us attend to the subordinations of things which it is our great business to explore. Among these there is such a subordination as that of means to ends, and of instruments to an operation. All will acknowledge the absurdity of the project of viewing light with a microscope. It is equally absurd for us to examine the nature of knowledge, of truth, of infinite wisdom, by our intellectual powers. We have a wide field of accessible knowledge in the works of God; and one of the greatest advantages, and of the most sublime pleasures, which we can derive from the contemplation, is the view which a judicious philosophical research will most infallibly give us of a world, not consisting of a number of detached objects, connected only by the fleeting tie of coexistence, but an *universe*, a *system* of beings, all connected together by causation, with innumerable degrees of subordination and subserviency, and all cooperating in the production of one great and glorious purpose. The heart which has but a spark of sensibility must be warmed by such a prospect, must be pleased to find itself an important part of this stupendous machine; and cannot but adore the incomprehensible Ar-

84 Philosophical disquisition gives just notions of God and of our own souls.

tist who contrived, created, and directs the whole. Let us not listen, then, to the timid admonitions of theological ignorance, which shrinks with superstitious horror from the thoughts of accounting for every thing by the powers of nature, and considers these attempts as an approach to atheism. Philosophical disquisition will, on the contrary, exhibit these general laws of the universe, that wonderful concatenation and adjustment of every thing both material and intellectual, as the most striking instance of incomprehensible wisdom; which, by means so few and so simple, can produce effects which by their grandeur dazzle our imagination, and by their multiplicity elude all possibility of enumeration. Of all the obstacles which the weakness, the folly, or the sinful vanity of men, has thrown in the way of the theologian, there is none so fatal, so hostile to all his endeavours, as a cold and comfortless system of materialism, which the reasoning pride of man first engendered, which made a figure among a few speculatists in the last century, but was soon forgotten by the philosophers really busy with the observation of nature and of nature's God. It has of late reared up its head, being now cherished by all who wish to get rid of the stings of remorse, as the only opinion compatible with the peace of the licentious and the sensual; for we may say to them as Henry IV. said to the prince of Wales, "Thy wish was father, Harry, to that thought." In vain will the divine attempt to lay this devil with the metaphysical exorcisms of the schools; it is philosophy alone that can detect the cheat. Philosophy singles out the characteristic phenomena which distinguish every substance; and philosophy never will hesitate in saying that there is a set of phenomena which characterise mind and another which characterise body, and that these are *toto cœlo* different. Continually appealing to fact, to the phenomena, for our knowledge of every cause, we shall have no difficulty in deciding that thought, memory, volition, joy, hope, are not compatible attributes with bulk, weight, elasticity, fluidity. *Tuta sub ægide Pallas;* philosophy will maintain the dignity of human nature, will detect the sophisms of the materialists, confute their arguments; and she alone will restore to the countenance of nature that ineffable beauty, of which those would deprive her, who would take away the supreme Mind which shines from within, and gives life and expression to every feature.

For a view of the progress of modern philosophy, see the Dissertations prefixed to the volumes of the SUPPLEMENT.

Natural PHILOSOPHY. See NATURAL *Philosophy*, PHILOSOPHY, and PHYSICS.

Experimental PHILOSOPHY. See EXPERIMENTAL *Philosophy*.

Moral PHILOSOPHY. See MORAL *Philosophy*.

PHILOSTORGIUS, an ecclesiastical historian of the 4th century, was born in Cappadocia, and wrote an abridgement of ecclesiastical history, in which he treats Athanasius with some severity. This work contains many curious and interesting particulars. The best edition is that of Henry de Valois in Greek and Latin. There is also attributed to him a book against Porphyry.

PHILOSTRATUS, FLAVIUS, was an ancient Greek author. He wrote the Life of Apollonius Tyanensis, and some other things which have come down to our time. Eusebius against Hierocles calls him an Athenian, because he taught at Athens; but Eunapius and Suidas always speak of him as a Lemnian: and he hints, in his Life of Apollonius, that he used to be at Lemnos when he was young. He frequented the schools of the sophists; and he mentions his having heard Damianus of Ephesus, Proclus Naucratitas, and Hippodromus of Larissa. This seems to prove that he lived in the reign of the emperor Severus, from 193 to 212, when those sophists flourished. He became known afterwards to Severus's wife Julia Augusta, and was one of those learned men whom this philosophic empress had continually about her. It was by her command that he wrote the Life of Apollonius Tyanensis, as he relates himself in the same place where he informs us of his connections with that learned lady. Suidas and Hesychius say that he was a teacher of rhetoric, first at Athens and then at Rome, from the reign of Severus to that of Philippus, who obtained the empire in 244.

Philostratus's celebrated work is his Life of Apollonius; which has erroneously been attributed to Lucian, because it has been printed with some of that author's pieces. Philostratus endeavours, as Cyril observes, to represent Apollonius as a wonderful and extraordinary person; rather to be admired and adored as a god than to be considered as a mere man. Hence Eunapius, in the preface to his Lives of the Sophists, says that the proper title of that work would have been, *The Coming of a God to Men;* and Hierocles, in his book against the Christians which was called *Philalethes*, and which was refuted by Eusebius in a work still extant, among other things drew a comparison between Apollonius and Jesus Christ. It has always been supposed that Philostratus composed his work with a view to discredit the miracles and doctrines of our Lord, by setting up other miracles and other doctrines against them, and this supposition may be true; but that Apollonius was really an impostor and magician may not be so certain. He may, for what we know, have been a wise and excellent person; and it is remarkable, that Eusebius, though he had the worst opinion of Philostratus's history, says nothing ill of Apollonius. He concluded that that history was written to oppose the history of Jesus; and the use which the ancient infidels made of it justifies his opinion; but he draws no information from it with regard to Apollonius. It would have been improper to have done so; since the sophistical and affected style of Philostratus, the sources from whence he owns his materials to have been drawn, and, above all, the absurdities and contradictions with which he abounds, plainly show his history to be nothing but a collection of fables, either invented or at least embellished by himself.

The works of Philostratus, however, have engaged the attention of critics of the first class. Grævius had intended to have given a correct edition of them, as appears from the preface of Meric Casaubon to a dissertation upon an intended edition of Homer, printed at London in 1658, 8vo. So had Bentley, who designed to add a new Latin version of his notes; and Fabricius says that he saw the first sheet of Bentley's edition printed at Leipsic in 1691. Both these designs were dropped. A very exact and beautiful edition was published at length at Leipsic, 1709, in folio, by Olearius, professor of the Greek and Latin tongues in that university; who has proved himself perfectly qualified for the work he undertook, and shown all the judgement, learning, and industry, that are required in an excellent editor.

See Apollonius, and Blount (Charles).

At the end of Apollonius's Life there are 95 letters which go under his name. They are not, however, believed to be his; the style of them being very affected, and like that of a sophist, while they bear in other respects all the marks of a forgery. Philostratus says that he saw a collection of Apollonius's Letters in Hadrian's library at Antium, but had not inserted them all among these. They are short, and have in them little else than moral sentences. The Lives of the Sophists contain many things which are to be met with nowhere else. The Heroics of Philostratus are only a dialogue between a vintner of Thracian Chersonesus and a Phœnician, in which the former draws characters of Homer's heroes, and represents several things differently from that poet; and this upon the faith of Protesilaus's ghost, who had lately visited his farm, which was not far from the tomb of this hero. Olearius conjectures, with much probability, that Philostratus's design in this dialogue was secretly to criticise some things in Homer, which he durst not do openly on account of the great veneration then paid to him, and for fear of the odium which Zoilus and others had incurred by censuring him too freely. The images are elegant descriptions and illustrations of some ancient paintings and other particulars relating to the fine arts; to which Olearius has subjoined the description of some statues by Callistratus; for the same reason that he subjoined Eusebius's book against Hierocles to the Life and Letters of Apollonius, namely, because the subjects of these respective works are related to each other. The last piece is a collection of Philostratus's Letters; but some of these, though it is not easy to determine which, were written by a nephew to our Philostratus, of the same name, as were also the last eighteen in the book of images. This is the reason why the title runs not *Philostrati*, but *Philostratorum quæ supersunt omnia.*

There were many persons of the name of Philostratus among the ancients; and there were many other works of the Philostratus here recorded, but no others are extant besides those we have mentioned.

PHILOTIS, a servant maid at Rome, saved her countrymen from destruction. After the siege of Rome by the Gauls, the Fidenates assembled an army, and marched against the capital, demanding all the wives and daughters in the city as the only conditions of peace. This demand astonished the senators; and when they refused to comply, Philotis advised them to send all the female slaves disguised in matrons clothes, and she offered to march herself at the head. Her advice was followed; and when the Fidenates had feasted late in the evening, and were quite intoxicated and fallen asleep, Philotis lighted a torch as a signal for her countrymen to attack the enemy. The whole was successful; the Fidenates were conquered; and the senate, to reward the fidelity of the female slaves, permitted them to appear in the dress of the Roman matrons.

PHILOXENUS, an officer of Alexander, who received Cilicia at the general division of the provinces. ——A son of Ptolemy, who was given to Pelopidas as an hostage.——A dithyrambic poet of Cythera. He enjoyed the favour of Dionysius tyrant of Sicily for some time, till he offended him by seducing one of his female singers. During his confinement Philoxenus composed an allegorical poem called *Cyclops;* in which he had delineated the character of the tyrant under the name of Polyphemus, and represented his mistress under the name of Galatæa, and himself under that of Ulysses. The tyrant, who was fond of writing poetry, and of being applauded, removed Philoxenus from his dungeon; but the poet refused to purchase his liberty by saying things unworthy of himself, and applauding the wretched verses of Dionysius, and therefore he was sent to the quarries. Being set at liberty, he some time after was asked his opinion at a feast about some verses which Dionysius had just repeated, and which the courtiers had received with the greatest applause. Philoxenus gave no answer, but he ordered the guards that surrounded the tyrant's table to take him back to the quarries. Dionysius was pleased with his pleasantry and with his firmness, and immediately forgave him. Philoxenus died at Ephesus about 380 years before Christ.

PHILTER, or **PHILTER**, (*Philtrum*), in *Pharmacy*, &c. a strainer.

PHILTER, is also used for a drug or preparation, which it is pretended will excite love.—The word is formed from the Greek φιλεω, "I love," or φιλος, "lover."

Philters are distinguished into *true* and *spurious*, and were given by the Greeks and Romans to excite love. The spurious are spells or charms, supposed to have an effect beyond the ordinary laws of nature by some magic virtue; such are those said to be given by old women, witches, &c.—The true philters are those supposed to work their effect by some natural and magnetical power. There are many grave authors who believe the reality of these philters, and allege matter of fact in confirmation of their sentiments: among the rest, Van Helmont, who says, that upon holding a certain herb in his hand for some time, and taking afterwards a little dog by the foot with the same hand, the dog followed him wherever he went, and quite deserted his former master; which he pretends to account for thus: The heat communicated to the herb, not coming alone, but animated by the emanations of the natural spirits, determines the herb towards the man, and identifies it to him: having then received this ferment, it attracts the spirit of the other object magnetically, and gives it an amorous motion. But this is mere cant; and all philters, whatever facts may be alleged, are mere chimeras.

PHILYCA. See **PHYLICA**, **BOTANY** *Index.*

PHILYRA, in fabulous history, was one of the Oceanides, whom Saturn met in Thrace. The god, to escape from the vigilance of Rhea, changed himself into a horse, to enjoy the company of Philyra, by whom he had a son half a man and half a horse, called *Chiron.*

Philyra was so ashamed of giving birth to such a monster, that she entreated the gods to change her nature. She was accordingly metamorphosed into a tree, called by her name among the Greeks.

PHIMOSIS, in *Medicine*, a disorder of the penis, in which the prepuce is so strict or tense, that it cannot be drawn back over the glans. See SURGERY.

PHINEHAS, or, as the Jews pronounce it **PINEHAS**, was the son of Eleazar, and grandson of Aaron. He was the third high-priest of the Jews, and discharged this office from the year of the world 2571, till towards the year 2590. He is particularly commended in Scripture for the zeal he showed in vindicating the glory of God, when the Midianites had sent their daughters into the camp of Israel, to tempt the Hebrews to fornication and idolatry. For Zimri having publicly entered into the tent of a Midianitish woman named *Cozbi*, Phinehas arose up from among the people (Numb. xxv. 7, &c.), took a javelin in his hand, entered after Zimri into that infamous place, and stabbed both man and woman at one blow, in those parts that were chiefly concerned in this criminal commerce. Upon which the plague or distemper ceased with which the Lord had already begun to punish the Israelites. This happened in the year of the world 2553.

Then the Lord said to Moses, Phinehas the son of Eleazar the high-priest has turned away my wrath from the children of Israel, because he has been zealous in my cause, and has hindered me from destroying them: wherefore acquaint him, that I give him my covenant of peace, and the priesthood shall be given to his posterity by a perpetual covenant, because he has been zealous for his God, and has made atonement for the crime of the children of Israel. This promise that the Lord made to Phinehas, to give him the priesthood by a perpetual covenant, interpreters observe, evidently included this tacit condition, that his children should continue faithful and obedient; since we know that the priesthood passed out of the family of Eleazar and Phinehas to that of Ithamar, and that it returned not to the posterity of Eleazar till after about 150 years.

This is what we find concerning the translation of the high-priesthood from one family to the other. This dignity continued in the race of Phinehas, from Aaron down to the high-priest Eli, for about 353 years. See AARON.

The manner and causes of this change are unknown. It re-entered again into the family of Eleazar, under the reign of Saul, when this prince having put to death Abimelech, and the other priests of Nob, he gave the high-priesthood to Zadok, who was of the race of Phinehas. At the same time, David had Abiathar with him of the race of Eli, who performed the functions of high-priest. So that after the death of Saul, David continued the priesthood to Zadok and Abiathar conjointly. But towards the end of David's reign, Abiathar having espoused the interest of Adonijah, to the prejudice of Solomon, he was in disgrace, and Zadok only was acknowledged as high-priest. The priesthood continued in his family till after the captivity of Babylon, and even to the destruction of the temple. But from the beginning of Zadok's priesthood alone, and the exclusion of Abiathar, to the ruin of the temple, is 1084 years.

We read of another memorable action of Phinehas, in which he still showed his zeal for the Lord. This was when the Israelites that were beyond Jordan had raised upon the banks of this river a vast heap of earth (Josh. xxii. 30, 31.). Those on the other side fearing they were going to forsake the Lord, and set up another religion, deputed Phinehas and other chief men among them, to go and inform themselves of the reason of erecting this monument. But when they had found that it was in commemoration of their union and common original, Phinehas took occasion from thence to praise the Lord, saying, "We know that the Lord is with us, since you are not guilty of that prevarication we suspected you were."

We do not exactly know the time of the death of Phinehas. But as he lived after the death of Joshua, and before the first servitude under Chushan-rishathaim, during the time that there were neither kings nor judges in the land, and every one did what was right in his own eyes (Judges xvii. 6. xviii. 1. xxi. 24.); his death is put about the year of the world 2590. It was under his pontificate that the story of Micah happened, as also that of the tribe of Dan, when they made a conquest of Laish; and the enormity that was committed upon the wife of the Levite of the mountain of Ephraim (Judges xx. 28.). Phinehas's successor in the high-priesthood was Abiezar, or Abishuah.

The Rabbins allow a very long life to Phinehas. There are some who believe he lived to the time of the high-priest Eli, or even to the time of Samson. Others will have it, that he was the same as Eli, or rather as the prophet Elias, which would still prolong his life for several ages.

PHINEUS, in fabulous history, was a son of Agenor, king of Phœnicia, or according to some of Neptune. He became king of Thrace, or, according to the greater part of mythologists, of Bithynia. He married Cleopatra the daughter of Boreas, called by some *Cleobula*, by whom he had Plexippus and Pandion. After her death, he married Idæa the daughter of Dardanus. Idæa, jealous of his former wife's children, accused them of attempts upon their father's life and crown, or, as others assert, of attempts upon her virtue; on which they were condemned by Phineus to be deprived of their eyes. This cruelty was soon after punished by the gods; for Phineus suddenly became blind, and the Harpies were sent by Jupiter to keep him in continual alarm, and to spoil the meats which were placed on his table. He was afterwards delivered from these dangerous monsters by his brothers in-law Zetes and Calais, who pursued them as far as the Strophades. He likewise recovered his sight by means of the Argonauts, whom he had received with great hospitality, and whom he instructed in the easiest and speediest way of arriving in Colchis. The causes of the blindness of Phineus are a matter of dispute among the ancients; some supposing that this was inflicted by Boreas for his cruelty to his grandsons; while others attribute it to the anger of Neptune, because he had directed the sons of Phryxus how to escape from Colchis to Greece. Many, however, imagine that it proceeded from his having rashly attempted to develope futurity; while others assert that Zetes and Calais put out his eyes on account of his cruelty to their nephews. The second wife of Phineus is called by some *Dia*, *Eurytia*, *Danae*, and *Idothea*.—He was killed by Hercules.

PHLEBOTOMY, the opening of a vein with a proper sharp-edged and pointed instrument, in order to let out a certain quantity of blood either for the preservation or recovery of a person's health. See SURGERY.

PHLEGM, in the animal economy, one of the four humours whereof the ancients supposed the blood to be composed. The chemists make phlegm or water an elementary body; the characters of which are fluidity, insipidity, and volatility.

PHLEGMAGOGUES, in *Medicine*, a term anciently made use of for such medicines as were supposed to be endowed with the property of purging off phlegm; such as hermodactyls, agaric, turbith, jalap, &c.

PHLEGMATIC, among physicians, an appellation given to that habit or temperament of body wherein phlegm is predominant; which gives rise to catarrhs, coughs, &c.

PHLEGMON, denotes an external inflammation and tumour, attended with a burning heat.

PHLEGON, who was surnamed *Trallianus*, was born in Trallis a city of Lydia. He was the emperor Hadrian's freed man, and lived to the 18th year of Antoninus Pius; as is evident from his mentioning the consuls of that year. He wrote several works of great erudition, of which we have nothing left but fragments. Among these was a History of the Olympiads, A Treatise of Long-lived Persons, and another of Wonderful Things; the short and broken remains of which Xylander translated into Latin, and published at Basil in 1568, with the Greek and with notes. Meursius published a new edition of them with his notes at Leyden, in 1622. The titles of part of the rest of Phlegon's writings are preserved by Suidas. It is supposed that the History of Hadrian, published under Phlegon's name, was written by Hadrian himself, from this passage of Spartianus: "Hadrian thirsted so much after fame (says he), that he gave the books of his own life, drawn up by himself, to his freedmen, commanding them to publish those books under their own names; for we are told that Hadrian wrote Phlegon's books."

Phlegon's name has been more familiar among the moderns, and his fragments have had a greater degree of regard paid to them than perhaps they deserve, merely because he has been supposed to speak of the darkness which prevailed during our Lord's passion. The book in which the words are contained is lost; but Eusebius has preserved them in his *Chronicon*. They are these: "In the 4th year of the 202d Olympiad, there was a greater and more remarkable eclipse of the sun than any that had ever happened before: for at the sixth hour the day was so turned into the darkness of night, that the very stars in the firmament were visible; and there was an earthquake in Bithynia which threw down many houses in the city of Nicæa." Eusebius thinks that these words of Phlegon related to the prodigies which accompanied Christ's crucifixion; and many other fathers of the church have thought the same: but this opinion is liable to many difficulties; for no man had ever a stronger desire than Phlegon to compile marvellous events, and to observe the supernatural circumstances in them. How was it then possible that a man of this turn of mind should not have taken notice of the most surprising circumstance in the eclipse which it is imagined he hints at, viz. its happening on the day when the moon was at the full? But had Phlegon done this, Eusebius would not have omitted it; and Origen would not have said that Phlegon had omitted this particular.

It was a matter of controversy some time ago, whether Phlegon really spoke of the darkness at the time of our Lord's passion; and many dissertations were written on both sides of the question. This dispute was occasioned by the above passage from Phlegon being left out in an edition of Clarke's Boyle's Lectures, published after his death, at the instance of Sykes, who had suggested to Clarke, that an undue stress had been laid upon it. Whiston, who informs us of this affair, expresses great displeasure against Sykes, and calls "the suggestion groundless." Upon this, Sykes published "A Dissertation on the Eclipse mentioned by Phlegon: or, "An Inquiry whether that Eclipse had any relation to the darkness which happened at our Saviour's Passion; 1732," 8vo. Sykes concludes it to be most probable that Phlegon had in view a natural eclipse which happened November 24, in the first year of the 202d Olympiad, and not in the 4th year of the Olympiad in which Christ was crucified. Many pieces were written against him, and to some of them he replied; but perhaps it is a controversy which concerns the learned world merely, since the cause of religion is but little affected by it.

Photius blames Phlegon for expatiating too much on trifles, and for collecting too great a number of answers pronounced by the oracles. "His style (he tells us) is not altogether flat and mean, nor does it everywhere imitate the attic manner of writing. But otherwise, the over nice accuracy and care with which he computes the Olympiads, and relates the names of the contests, the transactions, and even oracles, is not only very tiresome to the reader, whereby a cloud is thrown over all other particulars in that book, but the diction is thereby rendered unpleasant and ungrateful; and indeed he is every moment bringing in the answers pronounced by all kinds of deities."

PHLOGISTON, a term used by chemists to denote a principle which was supposed to enter into the composition of various bodies.

The bodies which were thought to contain it in the largest quantity are such as are inflammable; and the property which these substances possess of being susceptible of inflammation was thought to depend on this principle; and hence it was sometimes called the *Principle of Inflammability*. Inflammation, according to this doctrine, was the separation of *this principle* or *phlogiston* from the other matter which composed the combustible body. As its separation was always attended with the emission of light and heat, some chemists concluded that it was light and heat combined with other matter in a peculiar manner, or that it was some highly elastic and very subtile matter, on certain modifications of which heat and light depended.

Another class of bodies which were supposed to contain phlogiston are the metals; and the chemists supposed that the peculiar lustre of the metals depended on this principle. Of this they thought themselves convinced by the evidence of their senses in two ways; viz. first, because by exposing a metal to the action of a long continued heat, it lost its metallic lustre, and was converted into an earthy-like substance called *calx metallicus*, or *oxide;* and secondly, because by mixing this oxide with any inflammable substance whatever, and subjecting the mixture to certain operations, the inflammable matter disappeared, and the metal was restored to its former state and lustre, without suffering much diminution in quantity, especially if the processes had been conducted with care and attention.

This fact relative to the metals was thought to be a full demonstration of itself, independent of other proofs which were brought to support the doctrine. These were, that a combustible body, by the act of inflammation (i. e. by the dissipation of its phlogiston in the form of heat and light), was converted into a body that was no longer combustible, but which might have its property of combustibility restored to it again by mixing the incombustible remains with any kind of inflammable matter, and submitting the mixture to certain processes. In this way the body was restored to its former state of inflammability.

They were also at some pains to prove that the *phlogiston* or the *principle of inflammability* was the same in all inflammable bodies and in the metals. This identity of phlogiston they thought to be evident from the fact, that the calx of a metal might be restored to its metallic state, or that the remains after the combustion of a combustible body might be restored to its original state of combustibility by the addition of any inflammable body whatever, taken either from the animal, vegetable, or mineral kingdoms.

These and several other facts were brought to prove, not only the existence of phlogistion, but its effects in mixture with other substances; and the objections which were made against the doctrine were removed with wonderful ingenuity. The chief objection against it was, that if the inflammation of a combustible body, or the conversion of a metal into calx, depends on the dissipation or extrication of phlogiston; then it must follow, that the remains of a combustible body after inflammation, and the calx of the metal, must be less than the matter from which they were produced: but this is contrary to fact; for when we collect with care all the vapour into which the purest inflammable bodies are converted by combustion, these incombustible remains are much heavier than the inflammable body was from which they were produced, and the calx into which a metal is converted by long exposure to the action of heat is heavier than the metal from which it was produced. This consideration made several people doubt of the truth of the doctrine; but the objection was removed by saying, that phlogiston was so subtle, as not only to have no weight, but to possess an absolute levity; and that when it was taken from an absolutely heavy body, that body must, by losing so much absolute levity, become heavier, in the same manner as the algebraists say, that a positive quantity is augmented by the substraction of a negative quantity. This sophism satisfied the minds of most of the chemists, especially those who were algebraists.

The opinion that phlogiston was heat and light somehow combined with other matter, was proved, not only by the fact, that heat and light were emitted from a combustible body during its combustion, but from the reduction of certain metallic calces to the original metallic state again, at least in some degree, by simple exposure to heat and light. The white calx of silver, for instance, when exposed in close sealed glass vessels to the light and heat of the sun, resumes a black tinge, and is in part restored to its metallic lustre without any addition whatever; but then this restoration, like the others above mentioned, is attended with a loss of weight.

Besides constituting the principal part of inflammable bodies and metals, phlogiston was thought to be the cause of colour in all vegetable and animal substances. This was concluded from the fact of plants growing white when defended from the action of the sun's rays, and in having their green colour restored by exposure to his rays again; and so far did the chemists suffer themselves to be deceived, that they actually thought the green colouring matter, which they extracted from fresh plants by certain chemical processes, to be an inflammable substance. A very material objection was made to this argument, viz. if plants owe their colour to phlogiston imparted by the sun's rays, why do the sun's rays destroy vegetable colours that are exposed to them? for we know that the sun's rays are very effectual in diminishing the lustre of the cloth dyed with vegetable colours, and in bleaching or taking out various stains from linen and other substances. All this was removed by saying, that the sun's rays possessed different powers on living and on dead vegetable matter, and that the living vegetables had the power of absorbing phlogiston from the sun's rays, which dead vegetable matter had not.

Since the existence of phlogiston, as a chemical principle in the composition of certain bodies, is now fully proved to be false, we shall not trouble our readers with any farther observations on it, except adding, that although the chemists were satisfied with the proofs they gave of its reality, they were never able to exhibit it in a separate state, or show it in a pure form, unmixed with other matter.

Phlogiston seems to have been admitted as a principle in the composition of certain bodies, and to have been supposed the cause of certain modifications of matter, merely with a view to explain some of those natural phenomena which the authors of it were unable to explain on other principles. Subsequent discoveries in natural philosophy and in chemistry have represented things in a very different light from that in which the old chemists viewed them. The old chemists knew nothing but chemistry; they seldom extended their views to the observation of objects beyond their laboratories, and it was not till philosophers became chemists, and chemists philosophers, that chemistry began to wear the garb of science. The epoch in which this change began was in the time of Lord Verulam, who first removed the dimness from the chemist's eyes, and to him succeeded the honourable Mr Boyle. Sir Isaac Newton, with the little assistance which his predecessors in this branch of science afforded him, is in reality the first who established chemistry on scientific ground. It must, however, be acknowledged, that although he made a great progress, he left much undone; and subsequent chemists, who were less accurate observers of nature, admitted principles unwarrantably. From the time of Sir Isaac Newton till the middle of the 18th century, no real improvement was made in scientific chemistry; and the progress this science has made since that period is owing to the important discovery of the existence of heat in a state of composition with other matter. Heat thus combined loses its activity or becomes insensible, just in the same way as any other active substance loses its apparent qualities in composition. Acids, for example, when combined in a certain proportion with substances for which they have strong attraction, as alkalies or absorbent earths, lose all their obvious acid qualities, and the compound turns out mild, and totally conceals the acid which it contains. In a similar manner, heat, when combined in certain proportions with other matter, loses its sensible qualities, and the compound conceals the heat which it contains. Heat, in this combined state, was called by its ingenious discoverer, Dr Black, *latent heat*, and it was found to be very abundant in the atmosphere, which owes its existence as an elastic fluid to the quantity of latent heat that it contains. After this discovery was made, Dr Crawford, considering that air was absorbed by a burning body, concluded that the heat which appears in the combustion of a combustible body, is the heat that had before existed in the air which was consumed by the burning body. M. Lavoisier and others, prosecuting this inquiry, found that the combustible body, while it is burning, unites with the basis of the air, and that the heat which the air contained, and which was the cause of the air existing in the state of air, is expelled. This absorption of the basis of the air by the burning body, and the reduction of this basis to a solid form, accounts for the increase of weight which a body acquires by burning; or, in other words, gives a reason why the matter into which a combustible body is converted by combustion, is heavier than the body from which it was produced. The same absorption of air is observable, when a metal is converted into a calx, and the additional weight of the calx is found to be precisely equal to the weight of the air absorbed during the calcination. On these principles, therefore, we now explain the phenomena in a much more satisfactory manner than by the supposition of phlogiston, or a principle of inflammability. See Chemistry.

PHLOMIS, the Sage-tree, or *Jerusalem Sage*; a genus of plants belonging to the didynamia class. See Botany *Index*.

PHLOX, Lychnidea, or *Bastard Lychnis*; a genus of plants belonging to the pentandria class. See Botany *Index*.

PHLYCTENÆ, in *Medicine*, small eruptions on the skin.

PHOCA, a genus of quadrupeds of the order of feræ. See Mammalia *Index*.

PHOCÆA, the last town of Ionia, (Mela, Pliny); of Æolis, (Ptolemy), because situated on the right or north side of the river Hermus, which he makes the boundary of Æolis to the south. It stood far in the land, on a bay or arm of the sea; had two very safe harbours, the one called *Lampter*, the other *Naustathmos*, (Livy.) It was a colony of Ionians, situated in the territory of Æolis, (Herodotus). Massilia in Gaul was again a colony from it. *Phocæenses*, the people, (Livy); *Phocaicus*, the epithet, (Lucan); applied to *Marseilles*. It was one of the 12 cities which assembled in the Panionium or general council of Ionia.

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Some writers tell us, that while the foundations of this city were laying, there appeared near the shore a great shoal of sea-calves; whence it was called *Phocæa*, the word *phoca* signifying in Greek a *sea-calf*. Ptolemy, who makes the river Hermus the boundary between Æolia and Ionia, places Phocæa in Æolis; but all other geographers reckon it among the cities of Ionia. It stood on the sea-coast, between Cuma to the north, and Smyrna to the south, not far from the Hermus; and was, in former times, one of the most wealthy and powerful cities of all Asia; but is now a poor beggarly village, though the see of a bishop. The Phocæans were expert mariners, and the first among the Greeks that undertook long voyages; which they performed in galleys of fifty oars. As they applied themselves to trade and navigation, they became acquainted pretty early with the coasts and islands of Europe, where they are said to have founded several cities, namely, Velia in Italy; Alalia, or rather Aleria, in Corsica; and Marseilles in Gaul. Neither were they unacquainted with Spain; for Herodotus tells us, that in the time of Cyrus the Great, the Phocæans arriving at Sartessus, a city in the bay of Cadiz, were treated with extraordinary kindness by Arganthonius king of that country; who, hearing that they were under no small apprehension of the growing power of Cyrus, invited them to leave Ionia, and settle in what part of his kingdom they pleased. The Phocæans could not be prevailed upon to forsake their country; but accepted a large sum of money, which that prince generously presented them with, to defray the expence of building a strong wall round their city. The wall they built on their return; but it was unable to resist the mighty power of Cyrus, whose general Harpagus, investing the city with a numerous army, soon reduced it to the utmost extremities. The Phocæans, having no hopes of any succour, offered to capitulate; but the conditions offered by Harpagus seeming severe, they begged he would allow them three days to deliberate; and in the mean time, withdraw his forces. Harpagus, though not ignorant of their design, complied with their request. The Phocæans, taking advantage of this condescension, put their wives, children, and all their most valuable effects, on board several vessels which they had ready equipped, and conveyed them safe to the island of Chios, leaving the Persians in possession of empty houses. Their design was to purchase the Oenessian islands, which belonged to the Chians, and settle there. But the Chians not caring to have them so near, lest they should engross all the trade to themselves, as they were a seafaring people, they put to sea again; and, having taken Phocæa, their native country, by surprise, put all the Persians they found in it to the sword. They went to Corsica; great part of them however returned very soon, as did the rest also in a few years. They then lived in subjection either to the Persians, or tyrants of their own. Among the latter we find mention made of Laodamus, who attended Darius Hystaspis in his expedition against the Scythians; and of Dionysius, who, joining Aristagoras, tyrant of Miletus, and chief author of the Ionian rebellion, retired, after the defeat of his countrymen, to Phœnicia, where he made an immense booty, seizing on all the ships he met with trading to that country. From Phœnicia he sailed to Sicily, where he committed great depredations on the Carthaginians and Tuscans; but is said never to have molested the Greeks.

In the Roman times the city of Phocæa sided with

Antiochus the Great; whereupon it was besieged, taken, and plundered by the Roman general; but allowed to be governed by its own laws. In the war which Aristonicus brother to Attalus, king of Pergamus, raised against the Romans, they assisted the former to the utmost of their power; a circumstance which so displeased the senate, that they commanded the town to be demolished, and the whole race of the Phocæans to be utterly rooted out. This severe sentence would have been put in execution, had not the Massilienses, a Phocæan colony, interposed, and, with much difficulty, assuaged the anger of the senate. Pompey declared Phocæa a free city, and restored the inhabitants to all the privileges they had ever enjoyed; whence, under the first emperors, it was reckoned one of the most flourishing cities of all Asia Minor. This is all we have been able to collect from the ancients touching the particular history of Phocæa.

PHOCAS, a Roman centurion, was raised to the dignity of emperor by the army, and was crowned at Constantinople about the year 603. The emperor Mauritius, who was thus deserted both by the army and the people, fled to Chalcedon with his five children, whom Phocas caused to be inhumanly murdered before his eyes, and then he murdered Mauritius himself, his brother, and several other persons who were attached to that family.

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Phocas, thus proclaimed and acknowledged at Constantinople, sent, according to custom, his own image and that of his wife Leontia to Rome, where they were received with loud acclamations, the people there being incensed against Mauritius on account of the cruel exactions of the exarchs, and his other ministers in Italy. Gregory, surnamed the Great, then bishop of Rome, caused the images to be lodged in the oratory of the martyr Cæsarius, and wrote letters to the new emperor, congratulating him upon his advancement to the throne, which he said was effected by a particular providence, to deliver the people from the innumerable calamities and heavy oppressions under which they had long groaned. Had we no other character of Phocas and Leontia but that which has been conveyed to us in Gregory's letters, we should rank him amongst the best princes mentioned in history; but all other writers paint him in quite different colours; and his actions, transmitted to us by several historians, evidently speak him a most cruel and blood-thirsty tyrant. He was of middling stature, says Cedrenus, deformed, and of a terrible aspect: his hair was red, his eye-brows met, and one of his cheeks was marked with a scar, which, when he was in a passion, grew black and frightful: he was greatly addicted to wine and women, blood-thirsty, inexorable, bold in speech, a stranger to compassion, in his principles a heretic. He endeavoured, in the beginning of his reign, to gain the affections of the people by celebrating the Circensian games with extraordinary pomp, and distributing on that occasion large sums among the people; but finding that instead of applauding they reviled him as a drunkard, he ordered his guards to fall upon them. Some were killed, many wounded, and great numbers were dragged to prison: but the populace rising, set them at liberty, and thenceforth conceived an irreconcileable aversion to the tyrant.

As soon as the death of Mauritius was known, Narses, who then commanded the troops quartered on the frontiers of Persia, revolted. Phocas, however, managed matters so as to gain him over to his interest, and then treacherously and cruelly burnt him alive. He endeavoured to strengthen his cause by respectable alliances; but his cruelty was such as to render him generally hated, for he spared neither sex nor age, and amongst others he murdered Constantina the widow of Mauritius, and her daughters. These cruelties were at length the cause of his downfall. He became universally hateful; and persons in great authority near his person conspired against him. This conspiracy, however, was discovered, and the persons concerned in it were all put to death. The following year, however, 610, he was overtaken by the fate he had so long deserved.

Heraclius, the son of the governor of Africa, who bore the same name, taking upon him the title of emperor, and being acknowledged as such by the people of Africa, sailed from thence with a formidable fleet, and a powerful army on board, for Constantinople, while Nicetas marched thither by way of Alexandria and the Pentapolis. Heraclius steered his course to Abydus, where he was received with great demonstrations of joy by several persons of rank, who had been banished by Phocas. From Abydus he sailed to Constantinople, where he engaged and utterly defeated the tyrant's fleet. Phocas took refuge in the palace; but one Photinus, whose wife he had formerly debauched, pursuing him with a party of soldiers, forced the gates, dragged the cowardly emperor from the throne, and having stripped him of the imperial robes, and clothed him with a black vest, carried him in chains to Heraclius, who commanded first his hands and feet, then his arms, and at last his head, to be cut off: the remaining part of his body was delivered up to the soldiers, who burnt it in the forum. We are told, that Heraclius having reproached him with his evil administration, he answered, with great calmness, "It is incumbent upon you to govern better." Such was the end of this cruel tyrant, after he had reigned seven years and some months.

PHOCILIDES, a Greek poet and philosopher of Miletus, flourished about 540 years before the Christian era. The poetical piece now extant, attributed to him, is not of his composition, but of another poet who lived in the reign of Adrian.

PHOCION was a distinguished Athenian general and orator in the time of Philip II. of Macedon. His character is thus described in the Ancient Universal History. "He was too modest to solicit command, nor did he promote wars that he might raise his authority by them; though, taken either as a soldier, orator, statesman, or general, he was by far the most eminent Athenian of his time. As he was a most disinterested patriot, he could entertain no great affection for Philip: but as he perfectly well knew the disposition of his countrymen, and how unlikely they were long to support such measures as were necessary to humble the Macedonian power, he did not express himself vehemently, but chose rather to cultivate the esteem which on all occasions Philip showed for the state of Athens, as a mean of preserving her, when she should be reduced to that situation which he conceived they wanted virtue to prevent. From this character the reader will easily discern that

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Demosthenes and he could not well agree. The former was always warm, his language copious, and his designs extensive; and Phocion, on the other hand, was of a mild temper, delivered his opinion in very few words, and proposed schemes at once necessary and easy to be effected. Yet he seldom or never concurred with the people, but spoke as poignantly against their vices as Demosthenes himself; insomuch, that this orator once told him, 'The Athenians, Phocion, in some of their mad fits, will murder thee.' 'The same (answered he) may fall to thee, Demosthenes, if ever they come to be sober.'

He was afterwards appointed to command the army which was sent to assist the Byzantines against Philip, whom he obliged to return to his own dominions. This truly great man, whom (though extremely poor) no sum could bribe to betray his country, and who at every risk on all occasions gave them sound advice, was at length accused by his ungrateful countrymen. This event happened in the year before Christ 318. He was sent to Athens by Polysperchon head of a faction in Macedonia, together with his friends, chained in carts, with this message, "That though he was convinced they were traitors, yet he left them to be judged by the Athenians as a free people." Phocion demanded whether they intended to proceed against him by form of law; and some crying out that they would, Phocion demanded how that could be if they were not allowed a fair hearing: but perceiving, by the clamour of the people, that no such thing was to be expected, he exclaimed, "As for myself, I confess the crime objected to me, and submit to the judgment of the law; but consider, O ye Athenians, what have these poor innocent men done that they should be involved in the same calamity with me?" The people replied with great vociferation, "They are your accomplices, and that is enough." Then the decree was read, adjudging them all to death, viz. Phocion, Nicocles, Aheudippus, Agamon, and Pythocles; these were present: Demetrius Phalereus, Callimedon, Charicles, and others, were condemned in their absence. Some moved that Phocion might be tortured before he was put to death; nay, they were for bringing the rack into the assembly, and torturing him there. The majority, however, thought it enough if he was put to death, for which the decree was carried unanimously; some putting on garlands of flowers when they gave their votes. As he was going to execution, a person who was his intimate friend asked him if he had any message for his son? "Yes," replied Phocion; "tell him it is my last command that he forget how ill the Athenians treated his father."

The spleen of his enemies was not extinguished with his life: they passed a decree whereby his corpse was banished the Athenian territories; they likewise forbade any Athenians to furnish fire for his funeral pile. One Conopian took up the corpse, and carried it beyond Eleusina, where he borrowed some fire of a Megarian woman and burned it. A Megarian matron, who attended with her maid, raised on the place an honorary monument; and having gathered up the bones, carried them home, and buried them under her own hearth; praying at the same time thus to the Penates: "To you, O ye gods, guardians of this place, I commit the precious remains of the most excellent Phocion. Protect them, I beseech you, from all insults; and deliver them one day to be reposited in the sepulchre of his ancestors, when the Athenians shall become wiser." It was not long before this opportunity occurred. When the Athenians began to cool a little, and remember the many services they had received from Phocion, they decreed him a statue of brass; ordered his bones to be brought back at the public expence; and decreed that his accusers should be put to death. Agnonides, who was principally concerned in that tragedy, suffered; but Epicurus and Demophilus, who were also accomplices in it, fled. However, Phocion's son met with them, and executed his revenge upon them; which was almost the only good action he ever performed, as he had a very small share of his father's abilities, and not any of his virtues. Such is the fickleness and such the injustice of popular governments; failings which, if we are to judge from universal experience, are absolutely inseparable from them.

PHOCIS, (Demosthenes, Strabo, Pausanias); a country of Greece, contained between Bœotia to the east and Locris to the west, but extending formerly from the Sinus Corinthiacus on the south to the sea of Eubœa on the north, and, according to Dionysius, as far as Thermopylæ; but reduced afterwards to narrower bounds. *Phocenses*, the people; *Phocicus*, the epithet, (Justin); *Bellum Phocicum*, the sacred war which the Thebans and Philip of Macedon carried on against them for plundering the temple at Delphi; and by which Philip paved the way to the sovereignty of all Greece, (Justin). It greatest length was from north to south, that is, from 38° 45′ to 39° 20′, or about 35 miles; but very narrow from east to west, not extending to 30 miles, that is, from 23° 10′ to 23° 40′ at the widest, but about 23 miles towards the Corinthian bay and much narrower still towards the north. This country is generally allowed to have taken its name from Phocus the son of Ornytion, a native of Corinth; but having been soon after invaded by the Eginetæ, under the conduct of another Phocus, who was the son of Eacus king of Enopia, the memory of the first insensibly gave way to that of the second.

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In Phocis there were many celebrated mountains, such as Cythæron, HELICON, and PARNASSUS. The last two we have already noticed in the order of the alphabet. Cythæron was consecrated to the muses as well as the other two, and was consequently much celebrated by the poets. Both it and Helicon contend with Mount Parnassus for height and magnitude. There were no remarkable rivers in Phocis except Cephisus, which runs from the foot of Parnassus northward, and empties itself into the Pindus, which was near the boundary of that kingdom. It had several very considerable cities; such as Cyrra, Crissa, and Antecyra, which, according to Ptolemy, were on the sea coasts; and Pythia, Delphi, Daulis, Elatia, Ergosthenia, and Baulia, which were inland towns. Elatia was the largest and richest after Delphi.

Deucalion was king of that part of Phocis which lies about Parnassus, at the time that Cecrops flourished in Attica; but the Phocians afterwards formed themselves into a commonwealth, to be governed by their general assemblies, the members of which were chosen from among themselves, and were changed as often as occasion required. Of the history of the Phocians but little is known till the time of the holy war, of which we have the following account in the Ancient Universal History.

"The Phocians having presumed to plough the territories of the city of Cyrra, consecrated to the Delphic god, were summoned by the other Grecians states before the court of the Amphictyons, where a considerable fine was imposed upon them for their sacrilege. They refused to pay it, on pretence that it was too large; and at the next assembly their dominions were adjudged confiscated to the use of the temple. This second sentence exasperated the Phocians still more; who, at the instigation of one Philomelus, or, as he is called by Plutarch, Philomedes, seized upon the temple, plundered it of its treasure, and held the sacred depositum for a considerable time. This second crime occasioned another assembly of the Amphictyons, the result of which was a formal declaration of war against the Phocians. The quarrel being become more general, the several states took part in it according to their inclinations or interest. Athens, Sparta, and some others of the Peloponnesians, declared for the Phocians; and the Thebans, Thessalians, Locrians, and other neighbouring states, against them. A war was commenced with great fury on both sides, and styled *the holy war*, which lasted ten years; during which the Phocians, having hired a number of foreign troops, made an obstinate defence, and would in all probability have held out much longer had not Philip of Macedon given the finishing stroke to their total defeat and punishment. The war being ended, the grand council assembled again, and imposed an annual fine of 60 talents upon the Phocians, to be paid to the temple, and continued till they had fully repaired the damage it had sustained from them; and, till this reparation should be made, they were excluded from dwelling in walled towns, and from having any vote in the grand assembly. They did not, however, continue long under this heavy sentence: their known bravery made their assistance so necessary to the rest, that they were glad to remit it; after which remission they continued to behave with their usual courage and resolution, and soon obliterated their former guilt."

We cannot finish this article without mentioning more particularly Daulis, rendered famous, not so much for its extent or richness, as for the stature and prowess of its inhabitants; but still more for the inhuman repast which was served up to Tereus king of Thrace by the women of this city, by whom he was soon after murdered for the double injury he had done to his sister-in law Philomela, daughter of Pandion king of Athens. See PHILOMELA.

PHOEBUS, one of the names given by ancient mythologists to the Sun, Sol, or Apollo. See APOLLO.

PHŒNICIA, or more properly PHOENICE, the ancient name of a country lying between the 34th and 36th degrees of north latitude; bounded by Syria on the north and east, by Judæa on the south, and by the Mediterranean on the west. Whence it borrowed its name is not absolutely certain. Some derive it from one Phœnix; others from the Greek word *phœnix*, signifying a *palm* or *date*, as that tree remarkably abounded in this country. Some again suppose that Phœnice is originally a translation of the Hebrew word *Edom*, from the Edomites who fled thither in the days of David. By the contraction of Canaan it was also called *Chna*, and anciently *Rhabbothin* and *Colpitis* (A). The Jews commonly named it *Canaan;* though some part of it, at least, they knew by the name of *Syrophœnice* (B). Bochart tells us that the most probable etymology is *Phene Anak*, i. e. "the descendants of Anak." Such were the names peculiar to this small country; though Phœnice was sometimes extended to all the maritime countries of Syria and Judea, and Canaan to the Philistines, and even to the Amalekites. On the contrary, these two names, and the rest, were most generally swallowed up by those of Palestine and Syria (C).

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There is some disagreement among authors with respect to the northern limits of this country. Ptolemy makes the river Eleutherus the boundary of Phoenice to the north; but Pliny, Mela, and Stephanus, place it in the island of Aradus, lying north of that river. Strabo observes, that some will have the river Eleutherus to be the boundary of Seleucis, on the side of Phœnice and Cœlesyria. On the coast of Phœnice, and south of the river Eleutherus, stood the following cities: SIMYRA, Orthosia, TRIPOLIS, Botrys, Byblus, Palæbyblus, Berytus, SIDON, SAREPTA, TYRUS, Palætyrus.

Phœnice extended, according to Ptolemy, even beyond Mount Carmel; for that geographer places in Phœnice not only Ecdippa and Ptolemais, but Sycaminum and Dæra, which stand south of that mountain. These, however, properly speaking, belonged to Palestine. We will not take upon us to mark out the bounds of the midland Phœnice. Ptolemy reckons in it the following towns; Arca, Palæbyblus (Old Byblus), Gabala, and Cæsaria Paniæ. This province was considerably extended in the times of Christianity; when, being considered as a province of Syria, it included not only Damascus but Palmyra also.

The soil of this country is good, and productive of many necessaries for food and clothing. The air is wholesome, and the climate agreeable. It is plentifully watered by small rivers; which, running down from Mount Libanus, sometimes swell to an immoderate degree, either increased by the melting of the snows on that mountain, or by heavy rains. Upon these occasions they overflow, to the great danger and hinderance of the traveller and damage of the country. Among these rivers is that of ADONIS.

(A) This last name is a translation of the first. *Rabhotsen* is in Hebrew a *great gulf* or *bay*. From *rabhotsen*, by changing the Hebrew *ts* into the Greek *t*, comes *rabboten;* and, with a little variation, *rhabbothin*. Κολπος, *colpos*, is Greek also for a *bay* or *gulf;* whence it appears that *colpitis* or *colpites* is a translation of *rabbothin*.

(B) Bochart supposes that the borderers, both upon the Phœnician and Syrian side, were called by the common name of Syrophœnicians, as partaking equally of both nations.

(C) Or rather Phœnice, Palestine, and Syria, were promiscuously used for each other, and particularly the two former. Phœnice and Palestine, says Stephanus Byzantinus, were the same. As for Syria, we have already observed, that in its largest extent it sometimes comprehended Phœnice and Cœlesyria. Herodotus plainly confounds these three names; we mean, uses one for the other indifferently.

It is universally allowed that the Phœnicians were Canaanites (D) by descent: nothing is plainer or less contested, and therefore it were time lost to prove it. We shall only add, that their blood must have been mixed with that of foreigners in process of time, as it happens in all trading places; and that many strange families must have settled among them, who could consequently lay no claim to this remote origin, how much soever they may have been called Phœnicians, and reckoned of the same descent with the ancient proprietors.

The Phœnicians were governed by kings; and their territory, as small a slip as it was, included several kingdoms; namely, those of Sidon, Tyre, Aradus, Berytus, and Byblus. In this particular they imitated and adhered to the primitive government of their forefathers; who, like the other Canaanites, were under many petty princes, to whom they allowed the sovereign dignity, reserving to themselves the natural rights and liberties of mankind. Of their civil laws we have no particular system.

With regard to religion, the Phœnicians were the most gross and abominable idolaters. The Baal-berith, Baalzebub, Baalsamen, &c. mentioned in Scripture, were some of the Phœnician gods; as were also the Moloch, Ashtaroth, and Thammuz, mentioned in the sacred writings.—The word *Baal*, in itself an appellative, was no doubt applied to the true God, until he rejected it on account of its being so much profaned by the idolaters. The name was not appropriated to any particular deity among the idolatrous nations, but was common to many; however, it was generally imagined that one great God presided over all the rest. Among the Phœnicians this deity was named *Baal-samen;* whom the Hebrews would have called *Baal-shemim*, or the God of heaven. In all probability this was also the principal Carthaginian deity, though his Punic name is unknown. We have many religious rites of the Carthaginians handed down to us by the Greek and Roman writers; but they all bestowed names of their own gods upon those of the Carthaginians, which leads us to a knowledge of the correspondence between the characters of the Phœnician and European deities. The principal deity of Carthage, according to Diodorus Siculus, was Chronus or Saturn. The sacrifices offered up to him were children of the best families. Our author also tells us, that the Carthaginians had a brazen statue or colossus of this god, the hands of which were extended in act to receive, and bent downwards in such a manner, that the child laid thereon immediately fell down into a hollow where there was a fiery furnace. He adds also, that this inhuman practice seemed to confirm a tradition handed down to the Greeks from very early antiquity, viz. that Saturn devoured his own children.

The goddess Cœlestis, or Urania, was held in the highest veneration by the Carthaginians. She is thought to have been the same with the queen of heaven mentioned in Jeremiah, the Juno Olympia of the Greeks. According to Hesychius, the same word applied in the Punic language both to Juno and Venus: Nay, the ancient Greeks frequently confound Juno, Venus, and Diana or the moon, all together; which is to be attributed to the Egyptians and Phœnicians, from whom they received their system of religion; who seem in the most ancient times to have had but one name for them all. Besides these there were several other deities of later date, who were worshipped among the Phœnicians, particularly those of Tyre, and consequently among the Carthaginians also. These were Jupiter, Apollo, Mars, and Bacchus. Jupiter was worshipped under the name of *Belus* or *Baal*. To him they addressed their oaths; and placed him for the most part, as there is reason to believe, at the head of their treaties. The same name was also given to the other two, whence they were frequently mistaken for one another. Apollo or the sun, went either by this name simply, or by others of which this made a part.

The Carthaginian superstition, however, was not confined to these deities alone. They worshipped also the fire, air, and other elements; and had gods of rivers, meads, &c. Nay, they paid divine honours to the spirits of their heroes, and even to men and women themselves while yet in life; and in this adoration Hannibal the Great had for some time a share, notwithstanding the infamous conduct of his countrymen towards him at last. In order to worship those gods with more conveniency on all occasions, the Carthaginians had a kind of portable temples. These were only covered chariots, in which were some small images representing their favourite deities; and which were drawn by oxen. They were also a kind of oracle; and their responses were understood by the motion impressed upon the vehicle. This was likewise an Egyptian or Libyan custom; and Tacitus informs us that the ancient Germans had something of the same kind. The tabernacle of Moloch is thought to have been a machine of this kind; and it is not improbable that the whole was derived from the tabernacle of the Jews in the wilderness.

Besides all the deities above mentioned, we still find another, named the *Dæmon* or *Genius* of Carthage, mentioned in the treaty made by Philip of Macedon and Hannibal. What this deity might be, we know not; however, it may be observed, that the pagan world in general believed in the existence of dæmons, or intelligences who had a kind of middle nature between gods and men, and to whom the administration of the world was in a great measure committed. Hence it is no wonder that they should have received religious honours. For when once mankind were possessed with the opinion that they were the ministers of the gods, and trusted with the dispensation of their favours, as well as the infliction

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(D) Bochart insinuates that the Canaanites were ashamed of their name, on account of the curse denounced on their progenitor, and terrified by the wars so vigorously and successfully waged on them by the Israelites, purely because they were Canaanites; and that therefore, to avoid the ignominy of the one and the danger of the other, they abjured their old name, and changed it for Phœnicians, Syrians, Syrophœnicians, and Assyrians. Heidegger conjectures also that they were ashamed of their ancestor Canaan.

fliction of their punishments, it is natural to suppose that they would be desirous of making their addresses to them. See ASTARTE and POLYTHEISM.

Herodotus supposes the Phœnicians to have been circumcised; but Josephus asserts, that none of the nations included under the vague name of Palestine and Syria used that rite, the Jews excepted; so that if the Phœnicians had anciently that custom, they came in time to neglect it, and at length wholly laid it aside. They abstained however from the flesh of swine.

Much is said of their arts, sciences, and manufactures; but as what we find concerning them is couched in general terms only, we cannot descant on particulars. The Sidonians, under which denomination we comprehend the Phœnicians in general, were of a most happy genius. They were from the beginning addicted to philosophical exercises of the mind; insomuch that a Sidonian, by name Moschus, taught the doctrine of atoms before the Trojan war: and Abomenus of Tyre puzzled Solomon by the subtility of his questions. Phœnice continued to be one of the seats of learning, and both Tyre and Sidon produced their philosophers of later ages; namely, Boethus and Diodatus of Sidon, Antipater of Tyre, and Apollonius of the same place; who gave an account of the writings and disciples of Zeno. For their language, see PHILOLOGY, N° 61. As to their manufactures, the glass of Sidon, the purple of Tyre, and the exceeding fine linen they wove, were the product of their own country, and their own invention: and for their extraordinary skill in working metals, in hewing timber and stone; in a word, for their perfect knowledge of what was solid, great, and ornamental in architecture—we need only put the reader in mind of the large share they had in erecting and decorating the temple at Jerusalem under their king Hiram. Their fame for taste, design, and ingenious invention, was such, that whatever was elegant, great, or pleasing, whether in apparel, vessels, or toys, was distinguished by way of excellence with the epithet of Sidonian.

The Phœnicians were likewise celebrated merchants, navigators, and planters of colonies in foreign parts. As merchants, they may be said to have engrossed all the commerce of the western world: as navigators, they were the boldest, the most experienced, and greatest discoverers, of the ancient times: they had for many ages no rivals. In planting colonies they exerted themselves so much, that considering their habitation was little more than the slip of ground between Mount Libanus and the sea, it is surprising how they could furnish such supplies of people, and not wholly depopulate their native country.

It is generally supposed that the Phœnicians were induced to deal in foreign commodities by their neighbourhood with the Syrians, who were perhaps the most ancient of those who carried on a considerable and regular trade with the more eastern regions: and ~~this conjecture appears probable at least;~~ for their own territory was but small, and little able to afford any considerable exports, if we except manufactures: but that their manufactures were anyways considerable till they began to turn all the channels of trade into their own country, it is hard to believe. In Syria, which was a large country, they found store of productions of the natural growth of that soil, and many choice and useful commodities brought from the east. Thus, having a safe coast, with convenient harbours, on one side, and excellent materials for ship-building on the other; perceiving how acceptable many commodities that Syria furnished would be in foreign parts, and being at the same time, perhaps, shown the way by the Syrians themselves, who may have navigated the Mediterranean—they turned all their thoughts to trade and navigation, and by an uncommon application soon eclipsed their masters in that art.

It were in vain to talk of the Edomites, who fled hither in David's time; or to inquire why Herodotus supposes the Phœnicians came from the Red sea: their origin we have already seen. That some of the Edomites fled into this country in the days of David, and that they were a trading people, is very evident: what improvements they brought with them into Phœnice, it is hard to say; and by the way, it is as difficult to ascertain their numbers. In all probability they brought with them a knowledge of the Red sea, and of the south parts of Arabia, Egypt, and Ethiopia; and by their information made the Phœnicians acquainted with those coasts; by which means they were enabled to undertake voyages to those parts, for Solomon, and Pharaoh Necho, king of Egypt.

Their whole thoughts were employed on schemes to advance their commerce. They affected no empire but that of the sea; and seemed to aim at nothing but the peaceable enjoyment of their trade. This they extended to all the known parts they could reach; to the British isles, commonly understood by the Cassiterides; to Spain, and other places in the ocean, both within and without the straits of Gibraltar; and, in general, to all the ports of the Mediterranean, the Black sea, and the lake Mæotis. In all these parts they had settlements and correspondents, from which they drew what was useful to themselves, or might be so to others; and thus they exercised the three great branches of trade, as it is commonly divided into importation, exportation, and transportation, in full latitude. Such was their sea-trade; and for that which they carried on by land in Syria, Mesopotamia, Assyria, Babylonia, Persia, Arabia, and even in India, it was of no less extent, and may give us an idea of what this people once was, how rich and how deservedly their merchants are mentioned in Scripture as equal to princes. Their country was, at that time, the great warehouse, where every thing that might either administer to the necessities or luxury of mankind was to be found; which they distributed as they judged would be the best for their own interest. The purple of Tyre, the glass of Sidon, and the exceeding fine linen made in this country, together with other curious pieces of art in metals and wood, already mentioned, appear to have been the chief and almost only commodities of Phœnice itself. Indeed their territory was so small, that it is not to be imagined they could afford to export any of their own growth; it is more likely that they rather wanted than abounded with the fruits of the earth.

Having thus spoken in general terms of their trade, we shall now touch upon their shipping and some things remarkable in their navigation. Their larger embarkations were of two sorts; they divided them into round ships or gauli; and long ships, galleys, or triremes. When they drew up in line of battle, the gauli were disposed at a small distance from each other in the wings, or in the van and the rear: their triremes were contracted together in the centre. If, at any time, they observed that a stranger kept them company in their voyage, or followed in their track, they were sure to get rid of him if they could, or deceive him if possible; in which policy they went so far, as to venture the loss of their ships, and even their lives; so jealous were they of foreigners, and so tenaciously bent on keeping the whole trade to themselves. In order to discourage other nations from engaging in commerce, they practised piracy, or pretended to be at war with such as they met when they thought themselves strongest. This was but a natural stroke of policy in people who grasped at the whole commerce of the then known world. We must not forget here the famous fishery of Tyre, which so remarkably enriched that city. See ASTRONOMY, N° 7. OPHIR, and TYRE.

PHOENICOPTERUS, or FLAMINGO, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

PHOENIX, in *Astronomy*. See ASTRONOMY *Index*.

PHOENIX, the *Great Palm*, or *Date tree*, a genus of plants belonging to the order of palmæ. See BOTANY *Index*. As the account of this valuable plant already given in its proper place, under BOTANY, is rather short to be satisfactory, we shall here enter a little more into the detail of its natural history. There is only one species, viz. the dactylifera, or common date-tree, a native of Africa and eastern countries, where it grows to 50, 60, and 100 feet high. The trunk is round, upright, and studded with protuberances, which are the vestiges of the decayed leaves. From the top issues forth a cluster of leaves or branches eight or nine feet long, extending all around like an umbrella, and bending a little towards the earth. The bottom part produces a number of stalks like those of the middle, but seldom shooting so high as four or five feet. These stalks, says Adanson, diffuse the tree very considerably; so that, wherever it naturally grows in forests, it is extremely difficult to open a passage through its prickly leaves. The date-tree was introduced into Jamaica soon after the conquest of the island by the Spaniards. There are, however, but few of them in Jamaica at this time. The fruit is somewhat in the shape of an acorn. It is composed of a thin, light, and glossy membrane, somewhat pellucid and yellowish; which contains a fine, soft, and pulpy fruit, which is firm, sweet, and somewhat vinous to the taste, esculent, and wholesome; and within this is inclosed a solid, tough, and hard kernel, of a pale gray colour on the outside, and finely marbled within like the nutmeg. For medicinal use dates are to be chosen large, full, fresh, yellow on the surface, soft and tender, not too much wrinkled; such as have a vinous taste, and do not rattle when shaken. They are produced in many parts of Europe, but never ripen perfectly there. The best are brought from Tunis; they are also very fine and good in Egypt and in many parts of the east. Those of Spain and France look well; but are never perfectly ripe, and very subject to decay. They are preserved three different ways; some pressed and dry; others pressed more moderately, and again moistened with their own juice; and others not pressed at all, but moistened with the juice of other dates, as they are packed up, which is done in baskets or skins. Those preserved in this last way are much the best. Dates have always been esteemed moderately strengthening and astringent.

Though the date tree grows everywhere indiscriminately on the northern coasts of Africa, it is not cultivated with care, except beyond Mount Atlas; because the heat is not sufficiently powerful along the coasts to bring the fruits to proper maturity. We shall here extract some observations from Mr Des Fontaines respecting the manner of cultivating it in Barbary, and on the different uses to which it is applied. All that part of the Zaara which is near Mount Atlas, and the only part of this vast desert which is inhabited, produces very little corn; the soil being sandy, and burnt up by the sun, is almost entirely unfit for the cultivation of grain, its only productions of that kind being a little barley, maize, and sorgo. The date-tree, however, supplies the deficiency of corn to the inhabitants of these countries, and furnishes them with almost the whole of their subsistence. They have flocks of sheep; but as they are not numerous, they preserve them for the sake of their wool; besides, the flesh of these animals is very unwholesome food in countries that are excessively warm; and these people, though ignorant, have probably been enabled by experience to know that it was salutary for them to abstain from it. The date trees are planted without any order, at the distance of 12 feet one from the other, in the neighbourhood of rivulets and streams which issue from the sand. Forests of them may be seen here and there, some of which are several leagues in circumference. The extent of these plantations depends upon the quantity of water which can be procured to water them: for they require much moisture. All these forests are intermixed with orange, almond, and pomegranate trees, and with vines which twist round the trunks of the date trees; and the heat is strong enough to ripen the fruit, though they are never exposed to the sun.

Along the rivulets and streams, dykes are erected to stop the course of their waters, in order that they may be distributed amongst the date trees by means of small canals. The number of canals is fixed for each individual; and in several cantons, to have a right to them, the proprietors are obliged to pay an annual sum proportionable to the number and extent of their plantations. Care is taken to till the earth well, and to raise a circular border around the root of each tree, that the water may remain longer and in larger quantity. The date trees are watered in every season, but more particularly during the great heats of summer.

It is generally in winter that new plantations of this tree are formed. For this purpose those who cultivate them take shoots of those which produce the best dates, and plant them at a small distance one from the other. At the end of three or four years these shoots, if they have been properly taken care of, begin to bear fruit; but this fruit is as yet dry, without sweetness, and even without kernels; they never reach the highest degree of perfection of which they are susceptible till they are about 15 or 20 years old.

These plants are however produced from the seeds taken out of the fruit, provided they are fresh. They should be sown in pots filled with light rich earth, and plunged into a moderate hotbed of tanners bark, which should be kept in a moderate temperature of heat, and the earth frequently refreshed with water. When the plants are come up to a proper size, they should be each planted in a separate small pot, filled with the same light earth, and plunged into a hotbed again, observing to refresh them with water, as also to let them have air in proportion to the warmth of the season and the bed in which they are placed. During the summer time they should remain in the same hotbed; but in the beginning of August, they should have a great share of air to harden them against the approach of winter; for if they are too much forced, they will be so tender as not to be preserved through the winter without much difficulty, especially if you have not the conveniency of a bark stove to keep them in. The soil in which these plants should be placed, must be composed in the following manner, viz. half of light fresh earth taken from a pasture-ground, the other half sea sand and rotten dung or tanners bark in equal proportion; these should be carefully mixed, and laid in a heap three or four months at least before it is used, but should be often turned over to prevent the growth of weeds, and to sweeten the earth.

The trees, however, which spring from seed never produce so good dates as those that are raised from shoots; they being always poor and ill tasted. It is undoubtedly by force of cultivation, and after several generations, that they acquire a good quality.

The date trees which have been originally sown, grow rapidly, and we have been assured that they bear fruit in the fourth or fifth year. Care is taken to cut the inferior branches of the date tree in proportion as they rise; and a piece of the root is always left of some inches in length, which affords the easy means of climbing to the summit. These trees live a long time, according to the account of the Arabs; and in order to prove it, they say that when they have attained to their full growth, no change is observed in them for the space of three generations.

The number of females which are cultivated is much superior to that of the males, because they are much more profitable. The sexual organs of the date tree grow, as is well known, upon different stalks, and these trees flower in the months of April and May, at which time the Arabs cut the male branches to impregnate the female. For this purpose, they make an incision in the trunk of each branch which they wish to produce fruit, and place in it a stalk of male flowers; without this precaution the date tree would produce only abortive fruit (A). In some cantons the male branches are only shaken over the female. The practice of impregnating the date tree in this manner is very ancient. Pliny describes it very accurately in that part of his work where he treats of the palm tree.

There is scarcely any part of the date tree which is not useful. The wood, though of a spongy texture, lasts such a number of years, that the inhabitants of the country say it is incorruptible. They employ it for making beams and instruments of husbandry; it burns slowly, but the coals which result from its combustion are very strong, and produce a great heat.

The Arabs strip the bark and fibrous parts from the young date trees, and eat the substance which is in the centre; it is very nourishing, and has a sweet taste: it is known by the name of the marrow of the date tree. They eat also the leaves, when they are young and tender, with lemon juice; the old ones are laid out to dry, and are employed for making mats and other works of the same kind, which are much used, and with which they carry on a considerable trade in the interior parts of the country. From the sides of the stumps of the branches which have been left, arise a great number of delicate filaments, of which they make ropes, and which might serve to fabricate cloth.

Of the fresh dates and sugar, says Hasselquist, the Egyptians make a conserve, which has a very pleasant taste. In Egypt they use the leaves as fly-flaps, for driving away the numerous insects which prove so troublesome in hot countries. The hard boughs are used for fences and other purposes of husbandry; the principal stem for building. The fruit, before it is ripe, is somewhat astringent; but when thoroughly mature, is of the nature of the fig. The Senegal dates are shorter than those of Egypt, but much thicker in the pulp, which is said to have a sugary agreeable taste, superior to that of the best dates of the Levant.

A white liquor, known by the name of *milk*, is drawn also from the date tree. To obtain it, all the branches are cut from the summit of one of these trees, and after several incisions have been made in it, they are covered with leaves, in order that the heat of the sun may not dry it.

The sap drops down into a vessel placed to receive it, at the bottom of a circular groove, made below the incisions. The milk of the date tree has a sweet and agreeable taste when it is new; it is very refreshing, and it is even given to sick people to drink, but it generally turns sour at the end of 24 hours. Old trees are chosen for this operation, because the cutting of the branches, and the large quantity of sap which flows from them, greatly exhaust them, and often cause them to decay.

The male flowers of the date tree are also useful. They

(A) The celebrated Linnæus, in his Dissertation on the Sexes of Plants, speaking of the date tree, says, "A female date-bearing palm flowered many years at Berlin without producing any seeds; but the Berlin people taking care to have some of the blossoms of the male tree, which was then flowering at Leipsic, sent to them by the post, they obtained fruit by these means; and some dates, the offspring of this impregnation, being planted in my garden, sprung up, and to this day continue to grow vigorously. Kœmpfer formerly told us, how necessary it was found by the oriental people, who live upon the produce of palm-trees, and are the true *Lotophagi*, to plant some male trees among the females, if they hoped for any fruit; hence it is the practice of those who make war in that part of the world to cut down all the male palms, that a famine may afflict their proprietors; sometimes even the inhabitants themselves destroy the male trees when they dread an invasion, that their enemies may find no sustenance in the country."

They are eaten when still tender, mixed up with a little lemon juice. They are reckoned to be very provocative: the odour which they exhale is probably the cause of this property being ascribed to them.

These date trees are very lucrative to the inhabitants of the desert. Some of them produce 20 bunches of dates; but care is always taken to lop off a part of them, that those which remain may become larger; 10 or 12 bunches only are left on the most vigorous trees.

It is reckoned that a good tree produces, one year with another, about the value of 10 or 12 shillings to the proprietor. A pretty considerable trade is carried on with dates in the interior part of the country, and large quantities of them are exported to France and Italy. The crop is gathered towards the end of November. When the bunches are taken from the tree, they are hung up in some very dry place where they may be sheltered and secure from insects.

Dates afford wholesome nourishment, and have a very agreeable taste when they are fresh. The Arabs eat them without seasoning. They dry and harden them in the sun, to reduce them to a kind of meal, which they lay up in store to supply themselves with food during the long journeys which they often undertake across their deserts. This simple food is sufficient to nourish them for a long time.—The inhabitants of the Zaara procure also from their dates a kind of honey which is exceedingly sweet. For this purpose they choose those which have the softest pulp; and having put them into a large jar with a hole in the bottom, they squeeze them by placing over them a weight of eight or ten pounds.—The most fluid part of the substance, which drops through the hole, is what they call the *honey* of the date.

Even the stones, though very hard, are not thrown away. They give them to their camels and sheep as food, after they have bruised them or laid them to soften in water.

The date, as well as other trees which are cultivated, exhibits great variety in its fruit, with respect to shape, size, quality, and even colour. There are reckoned to be at least twenty different kinds. Dates are very liable to be pierced by worms, and they soon corrupt in moist or rainy weather.

From what has been said, it may easily be perceived, that there is, perhaps, no tree whatever used for so many and so valuable purposes as the date tree.

PHOENIX, in antiquity, a famous bird, which is generally looked upon by the moderns as fabulous. The ancients speak of this bird as single, or the only one of its kind; they describe it as of the size of an eagle; its head finely crested with a beautiful plumage, its neck covered with feathers of a gold colour, and the rest of its body purple, only the tail white, and the eyes sparkling like stars: they hold, that it lives 500 or 600 years in the wilderness; that when thus advanced in age, it builds itself a pile of sweet wood and aromatic gums, and fires it with the wafting of its wings, and thus burns itself; and that from its ashes arises a worm, which in time grows up to be a phœnix. Hence the Phœnicians gave the name of *phœnix* to the palm-tree; because when burnt down to the root it rises again fairer than ever.

In the sixth book of the Annals of Tacitus, sect. 28. it is observed that, in the year of Rome 787, the phœnix revisited Egypt; which occasioned among the learned much speculation. This being is sacred to the sun. Of its longevity the accounts are various. The common persuasion is, as we have mentioned above, that it lives 500 years; though by some the date is extended to 1461. The several eras when the phœnix has been seen are fixed by tradition. The first, we are told, was in the reign of Sesostris; the second is that of Amasis; and, in the period when Ptolemy the third of the Macedonian race was seated on the throne of Egypt, another phœnix directed its flight towards Heliopolis. When to these circumstances are added the brilliant appearance of the phœnix, and the tale that it makes frequent excursions with a load on its back, and that when, by having made the experiment through a long tract of air, it gains sufficient confidence in its own vigour, it takes up the body of its father and flies with it to the altar of the sun to be there consumed; it cannot but appear probable, that the learned of Egypt had enveloped under this allegory the philosophy of comets.

PHOENIX, son of Amyntor king of Argos by Cleobule or Hippodamia, was preceptor to young Achilles. His father having proved faithless to his wife, through fondness for a concubine called *Clytia*, Cleobule, who was jealous of him, persuaded her son Phœnix to ingratiate himself with his father's mistress. Phœnix easily succeeded; but Amyntor discovering his intrigues, he drew a curse upon him, and the son was soon after deprived of his sight by divine vengeance. Some say that Amyntor himself put out his son's eyes, which so cruelly provoked him that he meditated the death of his father. Reason and piety, however, prevailed over passion; and that he might not become a parricide, Phœnix fled from Argos to the court of Peleus king of Phthia. Here he was treated with tenderness; Peleus carried him to Chiron, who restored his eyesight; soon after which he was made preceptor to Achilles, his benefactor's son. He was also presented with the government of many cities, and made king of the Dolopes. He went with his pupil to the Trojan war; and Achilles was ever grateful for the instructions and precepts which he had received from him. After the death of Achilles, Phœnix, with others, was commissioned by the Greeks to return into Greece, to bring to the war young Pyrrhus. This commission he successfully performed; and after the fall of Troy, he returned with Pyrrhus, and died in Thrace. He was buried, according to Strabo, near Trachinia, where a small river in the neighbourhood received the name of *Phœnix*. There was another Phœnix, son of Agenor, by a nymph who was called *Telephassa*, according to Apollodorus and Moschus, or, according to others, *Epimedusa*, *Perimeda*, or *Agriope*. He was, like his brother Cadmus, and Cilix, sent by his father in pursuit of his sister Europa, whom Jupiter had carried away under the form of a bull; and when his inquiries proved unsuccessful, he settled in a country, which, according to some, was from him called *Phœnicia*. From him, as some suppose, the Carthaginians were called *Pœni*.

PHOLAS, a genus of shell-fish belonging to the order of vermes testacea. See CONCHOLOGY *Index*.

The word *pholas* is derived from the Greek, and signifies something which lies hid. This name they derive from their property of making themselves holes in the earth, sand, wood, or stone, and living in them. The means of their getting there, however, are as yet entirely unknown. All that we can know with certainty is, that they must have penetrated these substances when very small; because the entrance of the hole in which the pholas lodges is always much less than the inner part of it, and indeed than the shell of the pholas itself. Hence some have supposed that they were hatched in holes accidentally formed in stones, and that they naturally grew of such a shape as was necessary to fill the cavity.

The holes in which the pholades lodge are usually twice as deep, at least, as the shells themselves are long; the figure of the holes is that of a truncated cone, excepting that they are terminated at the bottom by a rounded cavity, and their position is usually somewhat oblique to the horizon. The openings of these holes are what betray the pholas being in the stone; but they are always very small in proportion to the size of the fish. There seems to be no progressive motion of any animal in nature so slow as that of the pholas; it is immersed in the hole, and has no movement except a small one towards the centre of the earth; and this is only proportioned to the growth of the animal. Its work is very difficult in its motion; but it has great time to perform it in, as it only moves downward, sinking itself deeper in the stone as it increases itself in bulk. That part by means of which it performs this, is a fleshy substance placed near the lower extremity of the shell; it is of the shape of a lozenge, and is considerably large in proportion to the size of the animal; and though it be of a soft substance, it is not to be wondered at that in so long a time it is able, by constant work, to burrow into a hard stone. The manner of their performing this may be seen by taking one of them out of the stone, and placing it upon some soft clay; for they will immediately get to work in bending and extending that part allotted to dig for them, and in a few hours they will bury themselves in the mud in as large a hole as they had taken many years to make in the stone. They find little resistance in so soft a substance; and the necessity of their hiding themselves evidently makes them hasten their work. The animal is lodged in the lower half of the hole in the stone, and the upper half is filled up by a pipe of a fleshy substance and conic figure, truncated at the end: this they usually extend to the orifice of the hole, and place on a level with the surface of the stone; but they seldom extend it any farther than this. The pipe, though it appears single, is in reality composed of two pipes, or at least it is composed of two parts separated by a membrane. The use of this pipe or proboscis is the same with that of the proboscis of other shell fish, to take in sea-water into their bodies, and afterwards to throw it out again. In the middle of their bodies they have a small green vessel, the use of which has not yet been discovered. This, when plunged in spirit-of-wine, becomes of a purple colour; but its colour on linen does not become purple in the sun like that of the murex.

The pholas is remarkable for its luminous quality, which was noticed by Pliny, who observes that it shines in the mouth of the person who eats it: and if it touch his hands or clothes, it makes them luminous. He also says that the light depends upon its moisture. The light of this fish has furnished matter for various observations and experiments to M. Reaumur and the Bolognian academicians, especially Beccarius, who took so much pains with the subject of phosphoreal light.

M. Reaumur observes, that whereas other fishes give light when they tend to putrescence, this is more luminous in proportion to its being fresh; that when they are dried, their light will revive if they be moistened either with fresh or salt water, but that brandy immediately extinguishes it. He endeavoured to make this light permanent, but none of his schemes succeeded.

The attention of the Bolognian academicians was engaged to this subject by M. F. Marsilius in 1744, who brought a number of these fishes, and the stones in which they were inclosed, to Bologna, on purpose for their examination.

Beccarius observed, that though this fish ceased to shine when it became putrid, yet that in its most putrid state it would shine, and make the water in which it was immersed luminous when it was agitated. Galeatius and Montius found that wine or vinegar extinguished this light; that in common oil it continued some days, but in rectified spirit of wine or urine hardly a minute.

In order to observe in what manner this light was affected by different degrees of heat, they made use of a Reaumur's thermometer, and found that water rendered luminous by those fishes increased in light till the heat arrived to 45°, but that it then became suddenly extinct, and could not be revived again.

In the experiments of Beccarius, a solution of sea-salt increased the light of the luminous water; a solution of nitre did not increase it quite so much. Sal ammoniac diminished it a little, oil of tartar *per deliquium* nearly extinguished it, and the acids entirely. This water, poured upon fresh calcined gypsum, rock-crystal, ceruse, or sugar, became more luminous. He also tried the effects of it when poured upon various other substances, but there was nothing very remarkable in them. Afterwards, using luminous milk, he found that oil of vitriol extinguished the light, but that of tartar increased it.

This gentleman had the curiosity to try how differently coloured substances were affected by this kind of light; and having, for this purpose, dipped several ribbons in it, the white came out the brightest, next to this was the yellow, and then the green: the other colours could hardly be perceived. It was not, however, any particular colour, but only light, that was perceived in this case. He then dipped boards painted with the different colours, and also glass tubes filled with substances of different colours, in water rendered luminous by the fishes. In both these cases, the red was hardly visible, the yellow was the brightest, and the violet the dullest. But on the boards, the blue was nearly equal to the yellow, and the green more languid; whereas in the glasses, the blue was inferior to the green.

Of all the liquors to which he put the pholades, milk was rendered the most luminous. A single pholas made seven ounces of milk so luminous, that the faces of persons might be distinguished by it, and it looked as if it were transparent.

Air appeared to be necessary to this light: for when Beccarius put the luminous milk into glass tubes, no agitation would make it shine unless bubbles of air were mixed with it. Also Montius and Galeatius found, that, in an exhausted receiver, the pholas lost its light, but the water was sometimes made more luminous: which they ascribed to the rising of bubbles of air through it.

Beccarius, as well as Reaumur, had many schemes to render the light of these pholades permanent. For this purpose he kneaded the juice into a kind of paste with flour, and found that it would give light when it was immersed in warm water; but it answered best to preserve the fish in honey. In any other method of preservation, the property of becoming luminous would not continue longer than six months, but in honey it had lasted above a year; and then it would, when plunged in warm water, give as much light as ever it had done. See Barbut's *Genera Vermium*, p. 14. &c.

PHOLEYS, or FOULIES, are a people of Africa, of very peculiar manners. Some authors tell us, that the kingdom of Pholey, from whence they derive their name, is divided from that of Jaloff by a lake called in the language of the Mundingoes *Cayor;* and that it stretches from east to west about 180 miles; but that, though it extends a great way south, its limits in that direction are not exactly ascertained.

Mr Moore, however, gives a very different account, and says, that the Pholeys live in clans, build towns, and are in every kingdom and country on each side of the river; yet are not subject to any of the kings of the country, though they live in their territories; for if they are used ill in one nation, they break up their towns, and remove to another. They have chiefs of their own, who rule with such moderation, that every act of government seems rather an act of the people than of one man. This form of government is easily administered, because the people are of a good and quiet disposition, and so well instructed in what is just and right, that a man who does ill exposes himself to universal contempt.

The natives of all these countries, not being avaricious of land, desire no more than they can use; and as they do not plough with horses or other cattle, they can use but very little; and hence the kings willingly allow the Pholeys to live in their dominions, and cultivate the earth.

The Pholeys have in general a tawney complexion, though many of them are of as deep a black as the Mundingoes; and it is supposed that their alliances with the Moors have given them the mixed colour between the true olive and the black. They are rather of a low stature, but have a genteel and easy shape, with an air peculiarly delicate and agreeable.

Though they are strangers in the country, they are the greatest planters in it. They are extremely industrious and frugal, and raise much more corn and cotton than they consume, which they sell at reasonable rates; and are so remarkable for their hospitality, that the natives esteem it a blessing to have a Pholey town in their neighbourhood; and their behaviour has gained them such reputation, that it is esteemed infamous for any one to treat them in an unhospitable manner. Their humanity extends to all, but they are doubly kind to people of their race; and if they know of any one of their body being made a slave, they will readily redeem him. As they have plenty of food, they never suffer any of their own people to want; but support the old, the blind, and the lame, equally with the others.

These people are seldom angry; and Mr Moore observes that he never heard them abuse each other; yet this mildness is far from proceeding from want of courage, they being as brave as any people of Africa, and very expert in the use of their arms, which are javelins, cutlasses, bows and arrows, and upon occasion guns. They usually settle near some Mundingo town, there being scarce any of note up the river that has not a Pholey town near it. Most of them speak Arabic, which is taught in their schools; and they are able to read the Koran in that language, though they have a vulgar tongue called *Pholey*. They are strict Mahometans, and scarce any of them will drink brandy, or any thing stronger than sugar and water.

They are so skilful in the management of cattle, that the Mundingoes leave theirs to their care. The whole herd belonging to a town feed all day in the savannahs, and after the crop is off, in the rice-grounds. They have a place without each town for their cattle, surrounded by a circular hedge, and within this enclosure they raise a stage about eight feet high, and eight or ten feet wide, covered with a thatched roof; all the sides are open, and they ascend to it by a ladder. Round this stage they fix a number of stakes, and when the cattle are brought up at night, each beast is tied to a separate stake with a strong rope made of the bark of trees. The cows are then milked, and four or five men stay upon the stage all night with their arms to guard them from the lions, tygers, and other wild beasts. Their houses are built in a very regular manner, they being round structures, placed in rows at a distance from each other to avoid fire, and each of them has a thatched roof somewhat resembling a high-crowned hat.

They are also great huntsmen, and not only kill lions, tygers, and other wild beasts, but frequently go 20 or 30 in a company to hunt elephants; whose teeth they sell, and whose flesh they smoke-dry and eat, keeping it for several months together As the elephants here generally go in droves of 100 or 200, they do great mischief by pulling up the trees by the roots, and trampling down the corn; to prevent which, when the natives have any suspicion of their coming, they make fires round their corn to keep them out.

They are almost the only people who make butter, and sell cattle at some distance up the river. They are very particular in their dress, and never wear any other clothes but long robes of white cotton, which they make themselves. They are always very clean, especially the women, who keep their houses exceedingly neat. They are, however, in some particulars very superstitious: for if they chance to know that any person who buys milk of them boils it, they will from thenceforth on no consideration sell that person any more, from their imagining that boiling the milk makes the cows dry.

PHOLIS, in *Natural History*, is an old name for gypsums or plaster-stones. The name is derived from φολις, a *scale* or *small flake*, because they are composed of particles of that form.

PHOLIS, in *Ichthyology*, is the name of a small anguilliform fish. The back is brown, the belly is white, the whole back and sides are spotted, and the skin is soft, free of scales, but with a tough mucilaginous matter like the eel. This species most of all approaches to the *alauda*; and though usually larger, yet Mr Ray doubts whether it really differs from it in any thing essential; the distinction is its colour, which though a very obvious is certainly a very precarious one.

PHONICS, the doctrine or science of sound, otherwise called ACOUSTICS, which see.

PHORMIUM, FLAX-PLANT, (*Phormium tenax*, Forst.) is a name which we may give to a plant that serves the inhabitants of New Zealand instead of hemp and flax. Of this plant there are two sorts; the leaves of both resemble those of flags, but the flowers are smaller, and their clusters more numerous; in one kind they are yellow, and in the other a deep red. Of the leaves of these plants, with very little preparation, they make all their common apparel, and also their strings, lines, and cordage, for every purpose; which are so much stronger than any thing we can make with hemp, that they will not bear a comparison.—From the same plant, by another preparation, they draw long slender fibres, which shine like silk, and are as white as snow: of these, which are very strong, they make their finest clothes; and of the leaves, without any other preparation than splitting them into proper breadths, and tying the strips together, they make their fishing-nets, some of which are of an enormous size.

The seeds of this valuable plant were brought over into England; but, upon the first trial, appeared to have lost their vegetating power. We understand however that it has since succeeded with the aid of artificial heat.

The filamentous parts of different vegetables have been employed in different countries for the same mechanic uses as hemp and flax among us. Putrefaction, and in some degree alkaline lixivia, destroy the pulpy or fleshy matter, and leave the tough filaments entire. By curiously putrefying the leaf of a plant in water, we obtain the fine flexible fibres, which constituted the basis of the ribs and minute veins, and which form as it were a skeleton of the leaf. In Madagascar, different kinds of cloth are prepared from the filaments of the bark of certain trees boiled in strong ley; and some of these cloths are very fine, and approach to the softness of silk, but in durability come short of cotton: others are coarser and stronger, and last thrice as long as cotton; and of these filaments they make sails and cordage to their vessels. The stalks of nettles are sometimes used for like purposes, even in France; and Sir Hans Sloane relates, in one of his letters to Mr Ray, that he has been informed by several, that muslin and callico, and most of the Indian linens, are made of nettles. A strong kind of cloth is said to be prepared in some of the provinces of Sweden of hop-stalks; and in the Transactions of the Swedish Academy for 1750, we have an account of an experiment relating to this subject: A quantity of stalks was gathered in autumn, which was equal in bulk to a quantity of flax sufficient to yield a pound after preparation. The stalks were put into water, and kept covered with it during the winter. In March, they were taken out, dried in a stove, and dressed as flax. The prepared filaments weighed nearly a pound, and proved fine, soft, and white; they were spun and wove into six ells of fine strong cloth. Unless the stalks are fully rotted, which will take much longer time than flax, the woody part will not separate, and the cloth will prove neither white nor fine.

PHOSPHATE is a saline body composed of phosphoric acid united to some base, as for instance, lime, which is called phosphate of lime. For an account of the different phosphates, see CHEMISTRY and MINERALOGY *Index*.

PHOSPHORUS, a name given to certain substances which shine in the dark without emitting heat. By this circumstance they are distinguished from the *pyrophori*, which though they take fire on being exposed to the air, are yet entirely destitute of light before this exposure.

Phosphori are divided into several kinds, known by the names of *Bolognian phosphorus*, *Mr Canton's phosphorus*, *Baldwin's phosphorus*, *phosphorus of urine*, &c. of which the last is by far the most remarkable both with respect to the quantity of light which it emits, and its property of taking fire and burning very fiercely upon being slightly heated or rubbed. For the method of preparing these, and for an account of their properties and combinations, see CHEMISTRY *Index*.

PHOTINIANS, in ecclesiastical history, were a sect of heretics in the fourth century who denied the divinity of our Lord. They derive their name from *Photinus* their founder, who was bishop of Sirmium, and a disciple of Marcellus. Photinus published in the year 343 his notions respecting the Deity, which were repugnant both to the orthodox and Arian systems. He asserted, that Jesus Christ was born of the Holy Ghost and the Virgin Mary: that a certain divine emanation, which he called the *Word*, descended upon him; and that because of the union of the divine word with his human nature, He was called the son of God and even God himself; and that the Holy Ghost was not a person, but merely a celestial virtue proceeding from the Deity. Both parties condemned the bishop in the councils of Antioch and Milan, held in the years 345 and 347. He was condemned also by the council at Sirmium in 351, and was afterwards degraded from the episcopal dignity, and at last died in exile in the year 372 or 375. His opinions were afterwards revived by Socinus.

PHOTIUS, patriarch of Constantinople, was one of the finest geniuses of his time, and his merit raised him to the patriarchate; for Bardas having driven Ignatius from the see, Photius was consecrated by Asbestus in 859. He condemned Ignatius in a synod, whereupon the pope excommunicated him, and he, to balance the account, anathematized the pope. Basilius of Macedon, the emperor whom Photius had reproved for the murder of Michael the late emperor, expelled him, and restored Ignatius; but afterwards re-established Photius, upon Ignatius's death, in 878. At last, being wrongfully accused of a conspiracy against the person of Leo the philosopher, son and successor to Basilius, he was expelled by him in 886, and is supposed to have died soon after. He wrote a *Bibliotheca*, which contains an examen of 280 authors: we have also 253 epistles of his; the *Nomacanon* under 14 titles; an abridgement of the acts of several councils, &c. This great man was born in Constantinople, and was descended from a very illustrious and noble family. His natural abilities were very great, and he cultivated them with the greatest assiduity.

siduity. There was no branch of literature, whether sacred and profane, and scarcely any art or science, in which he was not deeply versed. Indeed he appears to have been by far the greatest man of the age in which he lived; and was so intimately concerned in the chief transactions of it, that ecclesiastical writers have on that account called it *Seculum Photianum.* He was first raised to the chief dignities of the empire, being made principal secretary of state, captain of the guards, and a senator. In all these stations he acquitted himself with a distinction suitable to his great abilities, for he was a refined statesmen, as well as a profound scholar. His rise to the patriarchate was very quick; for when he was chosen to that office he was only a layman; but that he might be as it were gradually raised to that dignity, he was made monk the first day, reader the next, and the following days sub-deacon, deacon, and priest. So that in the space of six days he attained to the highest office in the church. On the whole, however, his ardent love of glory and unbounded ambition made him commit excesses which rendered him a scourge to those about him.

Fabricius calls his *Bibliotheca* or library, *non liber, sed insignis thesaurus,* "not a book, but an illustrious treasure," in which are contained many curious things, relating to authors, and many fragments of works which are no where else to be found. It was brought to light by Andreas Scottus, and communicated by him to David Hoeschelius, who caused it to be printed in 1601. Scottus, considering the great utility of this work, translated it into Latin, and printed his translation alone in 1606. The Greek text, together with the translation, was afterwards printed at Geneva in 1611.

PHOTOMETER, an instrument for ascertaining the intensity of light. See OPTICS *Index.*

PHRAATES, or PHRAHATES. There were four kings of this name in Parthia. See PARTHIA.

PHRASE, in *Grammar*, an elegant turn or manner of speech, peculiarly belonging to this or that occasion, this or that art, or this or that language. Thus we say, an Italian *phrase*, an eastern *phrase*, a poetical *phrase*, a rhetorical *phrase*.

PHRASE is sometimes also used for a short sentence or small set or circuit of words constructed together. In this sense, Father Buffier divides phrases into complete and incomplete.

Phrases are *complete* where there is a noun and a verb, each in its proper function; i. e. where the noun expresses a subject, and the verb the thing affirmed of it.

Incomplete phrases are those where the noun and the verb together only do the office of a noun; consisting of several words without affirming any thing, and which might be expressed in a single word. Thus, *that which is true*, is an incomplete phrase, which might be expressed in one word, *truth;* as, *that which is true satisfies the mind*, i. e. *truth satisfies the mind.*

PHRASEOLOGY, a collection of the phrases or elegant expressions in any language. See PHRASE.

PHREATIS, or PHREATTIUM, in Grecian antiquity, was a court belonging to the civil government of Athens, situated upon the sea-shore, in the Piræus. The name is derived from *απο τȣ φρεατος*, because it stood in a *pit*, or, as others suppose, from the hero *Phreatus.* This court heard such causes as concerned persons who had fled out of their own country for murder, or those that fled for involuntary murder, and who had afterwards committed a deliberate and wilful murder. The first who was tried in this place was Teucer, on a groundless suspicion that he had been accessory to the death of Ajax. The accused was not allowed to come to land, or so much as to cast anchor, but pleaded his cause in his bark; and if found guilty, was committed to the mercy of the winds and waves, or, as some say, suffered there condign punishment; if innocent, he was only cleared of the second fact, and, according to custom, underwent a twelvemonth's banishment for the former. See Potter's *Gr. Antiq.* vol. i. p. 111.

PHRENITIC, a term used to denote those who, without being absolutely mad, are subject to such strong sallies of imagination as in some measure pervert their judgment, and cause them to act in a way different from the more rational part of mankind.

PHRENITIS, the same with PHRENSY; an inflammation of the meninges of the brain, attended with an acute fever and delirium. See MEDICINE, N° 176; also an account of a strange degree of phrensy which attacked Charles VI. of France, in the article FRANCE, N° 88, 90.

PHRYGANEA, a genus of insects, belonging to the order neuroptera. See ENTOMOLOGY *Index.*

PHRYGIA, a country in Asia. From whence it derived its name is not certain: some say it was from the river Phryx (now Sarabat), which divides Phrygia from Caria, and empties itself into the Hermus; others from Phrygia, the daughter of Asopus and Europa. The Greek writers tell us, that the country took its name from the inhabitants, and these from the town of Brygium in Macedonia, from whence they first passed into Asia, and gave the name of *Phrygia* or *Brygia* to the country where they settled. Bochart is of opinion that this tract was called Phrygia from the Greek verb *φρυγειν*, "to burn or parch;" which, according to him, is a translation of its Hebrew name, derived from a verb of the same signification.

Ancient Universal History, vol. iii. p. 441, &c.

No less various are the opinions of authors as to the exact boundaries of this country; an uncertainty which gave rise to an observation made by Strabo, viz. that the Phrygians and Mysians had distinct boundaries; but that it was scarce possible to ascertain them. The same writer adds, that the Trojans, Mysians, and Lydians, are, by the poets, all blended under the common name of Phrygians, which Claudian extends to the Pisidians, Bithynians, and Ionians. Phrygia Proper, according to Ptolemy, whom we choose to follow, was bounded on the north by Pontus and Bithynia; on the west by Mysia, Troas, the Ægean sea, Lydia, Mæonia, and Caria; on the south by Lycia; on the east by Pamphylia and Galatia. It lies between the 37th and 41st degrees of north latitude, extending in longitude from 56 to 62 degrees. The inhabitants of this country, mentioned by Ptolemy, are the Lycaones and Anthemisenii, towards Lycia; and Moccadelis or Moccadine, the Cyddeses or Cydisses towards Bithynia; and between these the Peltini or Speltini, the Moxiani, Phylacenses, and Hierapolitæ. To these we may add the Berecyntes mentioned by Strabo.

Phrygia is commonly divided into the Greater and Lesser Phrygia, called also Troas. But this division did not take place till Troas was subdued by the Phrygians; and hence it is more considered by some Roman writers as a part of Phrygia, than Bithynia, Cappadocia, or any other of the adjacent provinces. In after ages, the Great Phrygia was divided into two districts or governments; one called Phrygia Pacatiana, from Pacatianus, who, under Constantine, bore the great office of the præfectus prætorio of the East; the other Phrygia Salutaris, from some miraculous cures supposed to have been performed there by the archangel Michael.

This country, and indeed all Asia Minor, as lying in the fifth and sixth northern climates, was in ancient times greatly celebrated for its fertility. It abounded in all sorts of grain; being, for the most part, a plain country covered with a deep rich soil, and plentifully watered by small rivers. It was in some parts productive of bitumen and other combustible substances. It was well stocked with cattle, having large plains and pasture grounds. The air was anciently deemed most pure and wholesome, though it is now in some parts thought extremely gross, great part of the country lying uncultivated.

In Phrygia Major were anciently several cities of great celebrity; such as APANEA, LAODICEA, HIERAPOLIS, Gordium, &c.—There were also some famous rivers; such as Marsyas, Mæander, &c. The Mæander is now called *Madre* or *Mindre*, and was much celebrated by the ancients for its windings and turnings; from whence all such windings and turnings have been denominated *mæanders*.

The Phrygians accounted themselves the most ancient people in the world. Their origin, however, is extremely dark and uncertain. Josephus and St Jerome say, they were descended from Togarmah, one of Gomer's sons: and that they were known to the Hebrews under the name of Tigrammanes. The Heathen authors derive them from the Brygians, a people of Macedonia. But this is but mere conjecture; and it is a conjecture totally unsupported, except by the similarity of names. Bochart thinks that the Phrygians were the offspring of Gomer the eldest son of Japhet: the word Phrygia being the Greek translation of his name. Josephus makes Gomer the father of the Galatians; but he, by the Galatians, must necessarily mean the Phrygians inhabiting that part of Phrygia which the Galatians had made themselves masters of; the descendants of Gomer being placed by Ezekiel northward of Judæa, near Togarmah (which Bochart takes to be Cappadocia), long before the Gauls passed over into Asia. We are willing to let Gomer enjoy the fine country which Bochart is pleased to give him, and allow him the honour of being the progenitor of the Phrygians, since we know no other person on whom it can be conferred with any degree of probability.

The ancient Phrygians are described as superstitious, voluptuous, and effeminate, without any prudence or foresight, and of such a servile temper, that nothing but stripes and ill usage could make them comply with their duty; which gave rise to several trite and well known proverbs (A). They are said to have been the first inventors of divination by the singing, flying, and feeding of birds. Their music, commonly called the *Phrygian mood*, is alleged by some as an argument of their effeminacy.

This government was certainly monarchical; for all Phrygia was, during the reigns of some kings, subject to one prince. Nannacus, Midas, Manis, Gordius, and his descendants, were undoubtedly sovereigns of all Phrygia. But some time before the Trojan war, we find this country divided into several petty kingdoms, and read of divers princes reigning at the same time. Apollodorus mentions a king of Phrygia contemporary with Ilus king of Troy. Cedrenus and others speak of one Teuthrans, king of a small country in Phrygia, whose territories were ravaged by Ajax, himself slain in single combat, his royal seat laid in ashes, and his daughter, by name Tecmessa, carried away captive by the conqueror. Homer makes mention of Phorcys and Ascanius, both princes and leaders of the Phrygian auxiliaries that came to the relief of Troy. Tantalus was king of Sipylus only, and its district; a prince no less famous for his great wealth, than infamous for his covetousness and other detestable vices. That Phrygia was subdued either by Ninus, as Diodorus Siculus informs us, or by the Amazons, as we read in Suidas, is not sufficiently warranted. Most authors that speak of Gordius tell us, that the Phrygians having sent to consult an oracle in order to know how they might put an end to the intestine broils which rent their country into many factions and parties, received for answer, that the most effectual means to deliver themselves and their country from the calamities they groaned under, was to commit the government to a king. This advice they followed accordingly, and placed Gordius on the throne.

Apamea was the chief emporium of all Asia Minor.—Thither resorted merchants and traders from all parts of Greece, Italy, and the neighbouring islands. Besides, we know from Syncellus, that the Phrygians were for some time masters of the sea; and none but trading nations ever prevailed on that element. The country produced many choice and useful commodities, which afforded considerable exports. They had a safe coast, convenient harbours, and whatever may incline us to think that they carried on a considerable trade. But as most of the Phrygian records are lost, we will not dwell on conjectures so difficult to be ascertained.

We have no set form of their laws; and as to their learning, since we are told that for some time they enjoyed the sovereignty of the sea, we may at least allow them a competent skill in geography, geometry, and astronomy; and add to these, from what we have said above, a more than ordinary knowledge of music.

Some have been of opinion that the Phrygian language bore a great resemblance to the Greek; but the

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(A) "Phryges sero sapiunt, Phryx verberatus melior, Phryx non minus quam Spyntharus, &c.:" which proverbs intimate their servile temper; and show that they were more fit to bewail misfortunes in an unmanly manner, than to prevent them by proper measures. Their music, too, was suited to their effeminate temper. The Doric mood was a kind of grave and solid music; the Lydian a doleful and lamentable harmony; but the Phrygian chiefly calculated to effeminate and enervate the mind. But this character is contradicted by others.

the contrary is manifest from the few Phrygian words which have been transmitted to us, and carefully collected by Bochart and Rudbechius. To these we may add the authority of Strabo, who, after attempting to derive the name of a Phrygian city from the Greek, concludes, that it is a difficult matter to discover any similitude between the barbarous words of the Phrygian language and the Greek. The Phrygian tongue, after the experiment made by Psammetichus king of Egypt, was looked upon by the Egyptians as the most ancient language of the world. But other nations, particularly the Scythians, refused to submit to their opinion, as founded on an argument of no real weight. "As the two children (say they) had never heard the voice of any human creature, the word *bec*, or *bekkos*, the first they uttered, was only an imitation of the goats that had suckled them, and happened to be a Phrygian word signifying *bread* (B).

We have already said, that the Phrygians were superstitious; their idols were consequently very numerous. The chief of these was Cybele, who went by a variety of names. (See CYBELE). They also worshipped Bacchus under the name of *Sabazios;* and his priests they called *Saboi.*

The history of their kings is dark and uncertain, and the dates of their several reigns and actions cannot now be fixed; we shall refer such of our readers, therefore, as wish to know what is certain respecting them, to the Ancient Universal History, already quoted more than once in the present article. See also GORDIUS, MIDAS, &c. For Phrygia Minor, see TROY.

PHRYGIAN STONE, in *Natural History*, is the name of a stone described by the ancients, and used by them in dyeing; perhaps from some vitriolic or aluminous salt contained in it, which served to enliven or fix the colours used by the dyers. It was light and spungy, resembling a pumice; and the whitest and lightest were reckoned the best. Pliny gives an account of the method of preparing it for the purpose of dyeing, which was by moistening it with urine, and then heating it red hot, and suffering it to cool.—This calcination was repeated three times, and the stone was then fit for use. Dioscorides recommended it in medicine after burning; he says it was drying and astringent.

PHRYGIANS, a Christian sect. See CATAPHRYGIANS and MONTANISTS.

PHRYNE, was a famous prostitute, who flourished at Athens about 328 years before the Christian era. She was mistress of Praxiteles, who drew her picture, which was one of his best pieces, and was placed in the temple of Apollo at Delphi. We are told that Apelles painted his Venus Anadyomene after he had seen Phryne on the sea-shore naked, and with dishevelled hair. Phryne became so very rich by the liberality of her lovers, that she offered to rebuild Thebes at her own expence, which Alexander had destroyed, provided this inscription was placed on the walls: *Alexander diruit, sed meretrix Phryne refecit;* which was refused. See *Plin.* 34. c. 8.——There was another of the same name who was accused of impiety. When she found that she was going to be condemned, she unveiled her bosom, which so influenced her judges, that she was immediately acquitted.

PHRYNICUS, a general of Samos, who endeavoured to betray his country, &c.——A flatterer at Athens. ——A tragic poet of Athens, disciple to Thespis. He was the first who introduced a female character on the stage.

PHRYNIS was a musician of Mitylene. He was the first who obtained a musical prize at the Panathenæa at Athens. He added two strings to the lyre, which had always been used with seven by all his predecessors. He flourished about 438 years before the Christian era. We are told that he was originally a cook at the house of Hiero king of Sicily.——There was another of the same name, a writer in the reign of Commodus, who made a collection, in 36 books, of phrases and sentences from the best Greek authors, &c.

PHRYXUS, in fabulous history, was a son of Athamas king of Thebes, by Nephele. When his mother was repudiated, he was persecuted with the most inveterate fury by his step-mother Ino, because he was to sit on the throne of Athamas, in preference to the children of a second wife. His mother apprized him of Ino's intentions upon his life; or, according to others, his preceptor; and the better to make his escape, he secured part of his father's treasures, and privately left Bœotia with his sister Helle, to go to their friend and relation Æetes king of Colchis. They embarked on board a ship, or, as we are informed by the fabulous account of the poets and mythologists, they mounted on the back of a ram, whose fleece was of gold; and proceeded on their journey through the air. The height to which they were carried made Helle giddy, and she fell into the sea. Phryxus gave his sister a decent burial on the sea-shore, and after he had called the place *Hellespont* from her name, he continued his flight, and arrived safe in the kingdom of Æetes, where he offered the ram on the altar of Mars. The king received him with great tenderness, and gave him Chalciope his daughter in marriage. She had by him Phrontis Melas, Argos Cylindrus, whom some call *Cytorus.* He was afterwards murdered by his father-in-law, who envied him the possession of the golden fleece; and Chalciope, to prevent her children from sharing their father's fate, sent them privately from Colchis to Bœotia, as nothing was to be dreaded there from the jealousy or resentment of Ino, who was then dead. The fable of the flight of Phryxus to Colchis on a ram has been explained by some, who observe, that the ship on which he embarked was either called by that name, or carried on her prow a figure of that animal. The fleece of gold is accounted for, by observing that Phryxus carried away immense treasures from Thebes. Phryxus was placed among the constellations of heaven after death. The ram which carried him to Asia is said to have been the fruit of Neptune's amour with Theophane the daughter of Altis. This ram the gods had given to Athamas in order to reward his piety and religious life; and Nephele procured it for her

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(B) Goropius Becanus makes use of the same argument, to prove that the High Dutch is the original or mother-tongue of the world, because the word *beker* in that language signifies "a baker."

her children, just as they were going to be sacrificed to the jealousy of Ino. Phryxus's murder was some time after amply revenged by the Greeks; it having occasioned the famous expedition achieved under Jason and many of the princes of Greece, which had for its object the recovery of the golden fleece, and the punishment of the king of Colchis for his cruelty to the son of Athamas.

PHTHIRIASIS, the Lousy Evil, from φθειρ, "a louse." Children are frequently its subjects, but adults are sometimes troubled with it. The increase of lice, when in a warm moist situation, is very great; but a cold and dry one soon destroys them. On the human body four kinds of lice are distinguished: 1. The *pediculi*, so called because they are more troublesome with their feet than by their bite. These are in the heads of children, especially if sore or scabby; and often in those of adults, if they are slothful and nasty. 2. Crab-lice. 3. Body lice; these infest the body, and breed in the clothes of the nasty and slothful. 4. A sort which breed under the cuticle, and are found in the hands and feet: they are of a round form, and so minute as often to escape the sight: by creeping under the scarf-skin they cause an intolerable itching; and when the skin bursts where they lodge, clusters of them are found there. See Acarus.

A good diet and cleanliness conduce much to the destruction of lice. When they are in the head, comb it every day; and, after each combing, sprinkle the pulv. sem. staph. agr. or coccul. Ind. among the hairs every night, and confine it with a tight cap.

Codrochius, in his treatise on lice, says, that the powdered coc. Ind. exceeds all other means; and that it may be mixed in the pulp of apple, or in lard, and applied every night to the hair. Some writers assert, that if the pulv. cort. rad. sassafr. be sprinkled on the head, and confined with a handkerchief, it destroys the lice in one night.

The body-lice are destroyed by any bitter, sour, salt, or mercurial medicine, it applied to the skin.

Black soap, and the flowers called *cardamine* or *lady's smock*, are said to be specifics in all cases of lice on the human body.

PHTHISIS, a species of consumption, occasioned by an ulcer in the lungs. See Medicine *Index*.

PHUL, or Pul, king of Assyria, is by some historians said to be Ninus under another name, and the first founder of that monarchy: A renowned warrior. He invaded Israel in the reign of Menahem, who became tributary to him, and paid him 1000 talents of silver for a peace. Flourished 771 B. C.

PHUT, or Phuth, the third son of Ham (Gen. x. 6.). Calmet is of opinion, that Phut peopled either the canton of Phtemphu, Phtemphuti, or Phtembuti, set down in Pliny and Ptolemy, whose capital was Thara in Lower Egypt, inclining towards Libya; or the canton called Phtenotes, of which Buthus was the capital. The prophets often spoke of Phut. In the time of Jeremiah, Phut was under the obedience of Necho king of Egypt. Nahum (iii. 9.) reckons up his people in the number of those who ought to have come to the assistance of No-ammon or Diospolis.

PHYLACETRY, in the general, was a name given by the ancients to all kinds of charms, spells, or characters, which they wore about them, as amulets, to preserve them from danger or diseases.

Phylactery particularly denoted a slip of parchment, wherein was written some text of Holy Scripture, particularly of the decalogue, which the more devout people among the Jews wore on the forehead, the breast, or the neck, as a mark of their religion.

The primitive Christians also gave the name *phylacteries* to the cases wherein they inclosed the relicks of their dead.

Phylacteries are often mentioned in the New Testament, and appear to have been very common among the Pharisees in our Lord's time.

PHYLICA, Bastard Alaternus; a genus of plants belonging to the pentandria class. See Botany *Index*.

PHYLLANTHUS, Sea-side Laurel; a genus of plants belonging to the monœcia class. See Botany *Index*.

PHYLLIS, in fabulous history, was a daughter of Sithon, or, according to others, of Lycurgus king of Thrace, who received Demophoon the son of Theseus; who, at his return from the Trojan war, had stopped on her coasts. She became enamoured of him, and did not find him insensible to her passion. After some months of mutual tenderness and affection, Demophoon set sail for Athens, where his domestic affairs recalled him. He promised faithfully to return as soon as a month was expired; but either his dislike for Phyllis, or the irreparable situation of his affairs, obliged him to violate his engagement: and the queen grown desperate on account of his absence, hanged herself, or, according to others, threw herself down a precipice into the sea and perished. Her friends raised a tomb over her body, where there grew up certain trees, whose leaves, at a particular season of the year, suddenly became wet as if shedding tears for the death of Phyllis. According to an old tradition mentioned by Servius, Virgil's commentator, Phyllis was changed by the gods into an almond tree, which is called *phylla* by the Greeks. Some days after this metamorphosis, Demophoon revisited Thrace; and when he heard of the fate of Phyllis, he ran and clasped the tree, which, though at that time stripped of its leaves, suddenly shot forth, and blossomed as if still sensible of tenderness and love. The absence of Demophoon from the house of Phyllis has given rise to a beautiful epistle of Ovid, supposed to have been written by the Thracian queen about the fourth month after her lover's departure.—A country woman introduced in Virgil's eclogues.—The nurse of the emperor Domitian.—A country of Thrace near Mount Pangæus.

PHYSALIS, the Winter Cherry; a genus of plants belonging the pentandria class. See Botany *Index*.

PHYSETER, or Spermaceti Whale, a genus belonging to the order of cete. See Cetology *Index*.

PHYSIC, or Physick, the art of healing; properly called Medicine. The word is formed from the Greek φυσις, "nature;" in regard medicine consists principally in the observation of nature. See Physics and Medicine.

PHYSICAL, something belonging to, or really existing in, nature. In this sense we say a physical point, in opposition to a mathematical one, which only exists in the imagination; a physical substance or body, in opposition to spirit, or metaphysical substance, &c.

PHYSICIAN, a person who professes medicine, or the art of healing diseases. See **MEDICINE**.

PHYSICIANS, College of, in London, Edinburgh, and Dublin. See *COLLEGE of Physicians.*

PHYSICO MATHEMATICS, includes those branches of physics which, uniting observation and experiment to mathematical calculation, undertake to explain the phenomena of nature.

PHYSICS,

1
General definition of physics.

TAKEN in its most enlarged sense, comprehends the whole study of nature; and NATURAL PHILOSOPHY is a term of the same extent: but ordinary language, and especially in this country, employs both of these terms in a much narrower sense, which it is proper in this place to determine with some precision.

2
A more particular explanation of the term.

Under the article PHILOSOPHY, we gave a particular account of that view of nature in which the objects of our attention are considered as connected by causation; and we were at some pains to point out the manner in which this study may be successfully cultivated. By a judicious employment of the means pointed out in that article, we discover that the objects of our contemplation compose an UNIVERSE, which consists, not of a number of independent existences solitary and detached from each other, but of a number of substances connected by a variety of relations and dependencies, so as to form a whole which may with great propriety be called the SYSTEM OF NATURE.

This assembling of the individual objects which compose the universe into one system is by no means the work of a hasty and warm fancy, but is the result of sober contemplation. The natural historian attempts in vain to describe objects, by only informing us of their shape, colour, and other sensible qualities. He finds himself obliged, in describing a piece of marble, for instance, to tell us that it takes a fine polish; that it strikes fire with steel; that it burns to quicklime; that it dissolves in aquafortis, and is precipitated by alkalies; that with vitriolic acid it makes gypsum, &c. &c. &c. and thus it appears that even the *description* of any thing, with the view of ascertaining its specific nature, and with the sole purpose of discrimination, cannot be accomplished without taking notice of its various relations to other things. But what do we mean by the *nature* of any thing? We are ignorant of its essence, or what makes it that thing and no other thing. We must content ourselves with the discovery of its *qualities* or *properties;* and it is the assemblage of these which we call its *nature*. But this is very inaccurate. These do not constitute its essence, but are the consequences of it. Yet this is all we shall ever know of its nature. Now the term *property* is nothing but a name expressing some relation which the substance under consideration has to other things. This is true of all such terms. Gravity, elasticity, sensibility, gratitude, and the like, express nothing but certain *matters of fact*, which may be observed respecting the object of our contemplation in different circumstances of situation with regard to other things. Our distinct notions of individuals, therefore, imply their relations to other things.

3
All parts of the universe evidently connected in their various properties.

The slightest observation of the universe shows an evident connection between all its parts in their various properties. All things on this earth are connected with each other by the laws of motion and of mind. We are connected with the whole of the solar system by gravitation. If we extend our observations to the fixed stars, the connection seems to fail; but even here it may be observed. Their inconceivable distance, it is true, renders it impossible for us to obtain any *extensive* information as to their nature. But these bodies are connected with the solar system by the sameness of the light which they emit with that emitted by our sun or any shining body. It moves with the same velocity, it consists (in most of them at least) of the same colours, and it is reflected, refracted, and inflected, according to the same laws.

4
Our attention naturally directed in the first instance to our fellow men.

In this unbounded scene of contemplation, our attention will be directed to the different classes of objects nearly in proportion to the interest we take in them. There is nothing in which we are so much interested as our fellow men; and one of the first steps that we make in our knowledge of nature, is an acquaintance with them. We learn their *distinctive* nature by attending to their *characteristic* appearances; that is, by observing their actions. We observe them continually producing, like ourselves, certain changes in the situation or condition of surrounding objects; and these changes are evidently directed to certain ends *which respect themselves*. Observing this subserviency of the effects which they produce to their own accommodation, we consider this adjustment of means to ends as the effect of an INTENTION, as we experience it to be in our own case, where we are conscious of this intention, and of these its effects.

5
Nature of intention.

We therefore interpret those actions of other men, where we observe this adjustment of means to ends, as marks or signs of intention in them similar to our own. And thus a quality, or power, or faculty, is *supposed* in them *by means of its sign*, although the quality itself is not *immediately* cognisable by our senses. And as this intention in ourselves is accompanied by perception of external objects, knowledge of their properties, desire of good, aversion from evil, volition and exertion, without all of which we could not or would not perform the actions which we daily perform, we *suppose* the same perception, knowledge, desire, aversion, volition, and exertion in them.

Thus, by the constitution of our mind, we consider the employment of means, by which ends terminating in the agent are gained, as the natural signs of design or intention. ART, therefore, or the employment of means, is the natural sign of intention; and wherever we observe this adjustment of means to ends, we infer the agency of design.

A small acquaintance with the objects around us, obliges us to extend this inference to a great number of beings besides our fellow men, namely, to the whole animal creation: for in all we observe the same subserviency to the ends of the agent in the changes which we find them continually producing in the objects around them. These changes are all adjusted to their own well-being. In all such cases, therefore, we are forced, by the constitution of our own minds, to infer the existence of design or intention in these beings also.

But in numberless changes produced by external objects on each other, we observe no such fitness in the effects, no such subserviency to the well-being of the agent. In such cases, therefore, we make no such inference of thought or design.

6.
All objects divided into thinking and unthinking beings.

Thus, then, there is presented to our observation an important distinction, by which we arrange all external objects into two classes. The first resembles ourselves, in giving external marks of that thought or intention of which we are conscious; and we *suppose* in them the other properties which we discover in ourselves, but cannot *immediately* observe in them, viz. thought, perception, memory, foresight, and all that collection of faculties which we feel in ourselves, and which constitute the animal. The other class of objects exhibits no such appearances, and we make no such inference. And thus we divide the whole of external nature into the classes of THINKING and UNTHINKING beings.

7
How we come to the knowledge of mind.

Our first judgments about these classes will be very inaccurate; and we will naturally ascribe the differences, which we do not very well understand, to the differences in organical structure, which we clearly observe. But when we have knocked down or perhaps smothered an animal, we find that it no longer gives the former mark of thought and intention, and that it now resembles the class of unthinking beings: And yet it still retains all that fitness of organical structure which it had before; it seems only to want the intention and the will. This obliges us to conclude that the distinction does not arise from a difference in organical structure, but from a distinct substance common to all thinking beings, but separable from their organical frame. To this substance we ascribe thought, intention, contrivance, and all that collection of faculties which we feel in ourselves. To this substance in ourselves we refer all sensations, pleasures, pains, remembrances, desires, purposes; and to this aggregate, however imperfectly understood, we give the name MIND. Our organical frame, which seems to be only the instrument of information and operation to the mind, we call *our* body.

8
The nature of mind as understood by mankind in rude ages.

As the animating principle is not, like our body, the immediate object of the senses, we naturally conceive it to be a substance essentially different from those which are the objects of our senses. The rudest people have shown a disposition to form this conclusion. Observing that animal life was connected with breathing, it was natural to imagine that breathing was living, and that breath was life. It is a remarkable fact, that in most languages the term for expressing *breath* is at least one of the terms for expressing the soul; רוח, *πνευμα*, *spiritus*, in the Hebrew, Greek and Latin, express both; *gheist*, or *ghost*, in the Teutonic, comes from *gheisen*, to "breath or sigh;" *dūcha* or *dūha*, "the soul," in Sclavonic, comes from *duichat*, "to breathe;" so in the Gaelic does *anal* come from *anam*; and the same relation is found between the two words in the Malay and other eastern languages. We believe that most persons can recollect some traces of this notion in their early conceptions of things; and many who do not consider themselves as uncultivated, believe that the soul quits the body *along with the last breath*. Among the Tartar nations hanging is considered with particular horror, on account of the ungraceful and filthy exit which the soul is obliged to make from the body.

9
Their opinion not just.

But the observation of the same appearances of thought and intention in fishes and other animals which do not breathe, would soon show that this was but a rude conception. Very little refinement indeed is necessary to convince us that air or breath cannot be the substance which thinks, wishes, and designs; and that the properties of this substance, whatever it is, must be totally different from, and incompatible with, any thing that we know of the immediate objects of our senses.

10
Of the two kinds of substances in nature, one is the object of reflection alone, the other of the senses.

Hence we are led to conclude that there are two kinds of substances in nature: One, which is the principle of sensation; and therefore *cannot* be the object of our senses, any more than light can be the object of the microscope. This substance alone can feel, think, desire, and propose, and is the object of *reflection alone*. The objects of our senses compose the other class, and therefore can have none of the other properties which are not cognoscible by the senses. These have all the properties which our senses can discover; and we can have no evidence of their having any other, nor indeed any conception of their having them. This class is not confined to the unorganized masses of matter; for we see that the bodies of animals lose after death that organical form, and are assimilated to all the rest of unthinking beings. It has arisen from such views as this, that while all nations have agreed to call this class of objects by the name BODY, which originally expresses our organical frame, some nations, farther advanced in cultivation or refinement, have contrived an abstract term to express this general substance of which all inanimate beings are composed. Such a term we have in the words *materies*, ὕλη.

11
The distinction between material and immaterial substances is very important.

Matter, then, is that substance which is immediately cognoscible by our senses. Whatever, therefore, is not thus immediately cognoscible by our senses is not material, and is expressed by a negative term, and called *immaterial*: hence it is that mind is said to be immaterial. It is of importance to keep in mind this distinction, merely grammatical. Little more is necessary for detecting the sophisms of Helvetius, Mirabeau, and other sages of the Gallic school, who have been anxious to remove the ties of moral and religious obligation by lowering our conceptions of our intellectual nature. It will also serve to show how hastily *they* have formed their opinions who have ascribed to the immediate agency of mind all those relations which are observed in the actions of bodies on each other at a distance. The connecting principles of such relations *è distante* (if there be any such), are not the immediate objects of our senses: they are therefore immaterial. But it does not follow that they are minds. There may be many immaterial substances which are not minds. We know nothing of any object whatever but by the observation of certain appearances, which suggest to our minds the existence and agency of its qualities or powers. Such phenomena are the natural signs of these qualities, and it is to those signs that we must always have recourse when we wish to conceive without ambiguity concerning them. What is the characteristic phenomenon of mind, or what is the *distinguishing* quality which brings it into view? It is INTENTION: and it may be asserted with the utmost confidence, that we have no other mark by which mind is immediately suggested to us, or that would ever have made us suppose that there existed another mind besides our own. The *phenomenon* by which this quality is suggested to us is *art*, or the employment of means to gain ends; and the mark of art is the supposed conduciveness of these ends to the well-being of the agent. Where this train is not observed, design or intention is never thought of; and therefore where intention is not perceived in any immaterial substance, if any such has ever been observed, it is an abuse of language to call it mind. We do not think that even perception and intelligence entitle us to give the name mind to the substance in which they are inherent, because it is from marks of intention alone that we infer the existence of mind; and although these must be accompanied with perception and intelligence, it does not follow that the substance which can perceive and understand must also desire and propose. However difficult we may find it to separate them, they are evidently separable in imagination. And let not this assertion be too hastily objected to; for the separation *has been made* by persons most eminent for their knowledge and discernment. When Leibnitz ascribed to his MONADES, or what we call the ultimate ATOMS of matter, a perception of their situation in the universe, and a motion precisely suited to this perception, he was the farthest in the world from supposing them animated or endowed with minds. It is true indeed, that others, who think and call themselves philosophers, are much more liberal in their application of this term. A modern author of great metaphysical eminence says, "I call that *mind* which moves, and that *body* which is moved." This class of philosophers assert that no motion whatever is begun except by the agency of an animating principle, which (after Aristotle) they call *Nature*, and which has in these days been exalted to the rank of a god. All this jargon (for it is nothing else) has arisen from the puzzle in which naturalists think themselves involved in attempting to explain the production of motion in a body at a distance from that body which is conceived as the cause of this motion. After having been reluctantly obliged, by the reasonings of Newton, to abandon their methods of explaining such phenomena by the impulses of an intervening fluid, nothing seemed left but the assertion that these motions were produced by minds, as in the case of our own exertions. These explanations (if they deserve the name) cannot be objected to in any other way than as an abuse of language, and as the introduction of an unmeaning jargon. We have, and can have, no notion of mind different from those of our own minds; and we discover the existence of other minds as we discover the existence of bodies, by means of phenomena which are characteristic of minds, that is, which resemble those phenomena that follow the exertion of our own mental faculties, that is, by the employment of means to attain selfish ends; and where such appearances are not observed, no existence of a mind is inferred. When we see a man fall from the top of a house, and dash out his brains on the pavement, we never ascribe this motion to his mind. Although the fitness of many of the celestial motions for most important purposes make us suppose design and contrivance somewhere, and therefore a *Supreme Mind*, we no more think of inferring a mind in the earth from the fitness of its motions for purposes most beneficial to its inhabitants, than of inferring a mind in a bit of bread from its fitness for nourishing our bodies. It is not from the mere motions of animals that their minds are inferred, but from the conduciveness of these motions to the well-being of the animal.

12
The mind is not that which produces motion, but that which desires and wills.

The term mind therefore, in the *ordinary language* of all men, is applied to what desires and wills at the same time that it perceives and understands. If we call that mind which *produces motion*, we must derive our notions of its qualities or attributes from observing their effects. We must therefore discover the general laws by which they act, that is, the general laws observed in those motions which we consider as their effects. Now these are the general laws of motion; and in none of these can we find the least coincidence with what we are accustomed to call the laws of mind. Nay, it has been the total want of similarity which has given rise to the distinction which all men, in all ages and countries, have made between mind and matter. This distinction is found in all languages; and it is an unpardonable liberty which men take with language when they use a *term of distinction*, a *specific term*, to express things of a different species. What these authors have been pleased to call *mind*, the whole world besides have called by another name, FORCE; which, though borrowed from our own exertions, is yet sufficiently distinctive, and never leads us to confound things that are different, except in the language of some modern philosophers, who apply it to the laws of the agency of mind; and, when speaking of the force of motives, &c. commit the same mistakes which the followers of Aristotle commit in the use of the term mind, *Force*, in the language of these philosophers, means what connects the operations of mind; as mind, in the language of Lord Monboddo, is that which connects the operations of body.

13
The principle of motion not distinct from matter and mind.

These are not less to blame who consider this *Nature* of Aristotle, this principle of motion, as an existence or substance different both from matter and from the minds of intelligent creatures. Aristotle calls it in some places ὡσπερ ψυχη. He might with equal propriety, and equal consistency with his other doctrines, have called mind, ὡσπερ τελος, or an ὡσπερ δυναμις. Besides, we have no evidence for the separability of this ὡσπερ ψυχη from body as we have for the separability of such minds as our own, the genuine ψυχαι. Nay, his whole doctrines, when maturely considered, assume their absolute inseparability.

14
Elemental minds are an abuse of language.

This doctrine of elemental minds, therefore, as the immediate causes of the phenomena of the material world, is an abuse of language. It is a jargon; and it is a frivolous abuse, for it offers no explanation whatever. The phenomena are totally unlike the phenomena of ordinary minds, and therefore receive no explanation from them; and since our knowledge of these *quasi* minds must be derived entirely from the phenomena, it will be precisely the same, although we express it in common language. We shall not indeed raise the wonder of our hearers, as those do who fill the world with minds which they never suspected to exist; but we shall not bewilder their imaginations, confound their ideas, and mislead their judgments.

15 The dreadful consequences of materialism.

We flatter ourselves that our readers will not think these observations unseasonable or misplaced. Of all mistakes that the naturalist can fall into, there is none more fatal to his progress in knowledge than the confounding things which are essentially different; and of all the distinctions which can be made among the objects of our contemplation, there is none of equal philosophical importance with this between mind and matter: And when we consider the consequences which naturally follow from this confusion of ideas, and particularly those which follow from sinking the mental faculties of man to a level with the operations of mechanics or chemistry, consequences which the experience of the present eventful day shows to be destructive of all that is noble or desirable in human nature, and of all that is comfortable in this life, and which blasts every hope of future excellence—we cannot be too anxious to have this capital distinction put in the plainest point of view, and expressed in the most familiar characters, "so that he who runneth may read." When we see the frenzy which the reasoning pride of man has raised in our neighbourhood, and hear the dictates of philosophy incessantly appealed to in defence of whatever our hearts shudder at as shocking and abominable; and when we see a man (A), of great reputation as a naturalist, and of professed humanity and political moderation, congratulating his countrymen on the rapid improvement and almost perfection of philosophy; and after giving a short sketch of the constitution of the visible universe, summing up all with a table of elective attractions, and that particular combination and mode of crystallization which constitutes GOD (*horresco referens!*)—is it not full time for us to stop short, and to ask our own hearts "whither are you wandering?"—But sound philosophy, reasoning from effects to their causes, will here listen to the words of our sacred oracles: "By their fruits ye shall know them. Do men gather grapes of thorns, or figs of thistles?" The absurd consequences of the sceptical philosophy of Berkeley and Hume have been thought, by men of undoubted discernment, sufficient reasons for rejecting it without examination. The no less absurd and the shocking consequences of the mechanical philosophy now in vogue should give us the same abhorrence; and should make us abandon its blood-stained road, and return to the delightful paths of nature, to survey the works of God, and feast our eyes with the displays of mind, which offer themselves on every hand in designs of the most extensive influence and the most beautiful contrivance. Following the guidance of heavenly wisdom, we shall indeed find, that "all her ways are ways of pleasantness, and all her paths are peace."

16 The extent of philosophical study.

Such is the scene of our observation, the subject of philosophical study. Its extent is almost unbounded, reaching from an atom to God himself. It is absolutely necessary for the successful cultivation of this immense field of knowledge, that it be committed to the care of different cultivators, and that its various portions be treated in different ways: and, accordingly, the various tastes of men have given this curiosity different directions; and the study, like all other tasks, has been promoted by this division of labour.

Some philosophers have attended only to the appearances of fitness which are exhibited in every quarter of the universe; and by arranging these into different classes, and interpreting them as indications of thought and intention, have acquired the knowledge of many classes of sentient and intelligent beings, actuated by propensities, and directed by reason.

17 The nature and uses of animal instincts.

While the contemplation of these appearances indicates thought and design in any individual of one of these classes, and brings its propensities and purposes of action, and the ends gained by these actions, into view, the contemplation of these propensities, purposes, and ends, occasions an inference of a much more general kind. All these intelligent beings give indications of knowledge and of power; but their knowledge bears, in general, no proportion to their power of producing changes in nature, and of attaining important ends; and their power is neither always, nor in the most important cases, the consequence of their knowledge. Where the effect of their actions is most eminently conducive to their important interests, the power of attaining these valuable ends is generally independent on any attention to the fitness of the means, and the exertion is frequently made without even thinking of the important end. The well-being of the individual is secured against any danger from its ignorance, indolence, or inattention, by an instinctive propensity, which leads it to the performance of the necessary action, which is thus made immediately and ultimately desirable, without any regard to its ultimate and important end. Thus, in our own nature, the support of animal life, and the improvement of the means of subsistence by a knowledge of the objects which surround us, are not entrusted to our apprehensions of the importance of these ends, but are committed to the surer guides of hunger and curiosity.

18 There is a connection between the individuals of a class of animals different from that of resemblance.

The same observers discover a connection between the individuals of a class, different from that which arises from the mere resemblance of their external appearance, or even of their propensities and pursuits; the very circumstances which produced the classification. They observe, that these propensities are such, that while each individual seeks only its own enjoyment, these enjoyments are in general such as contribute to the support of the species and the enjoyment of other individuals. Thus, in the classes of animals, and in human nature, the continuance of the race, and the enjoyment of the whole, are not entrusted to the apprehension we entertain of the importance of these ends, but are produced by the operation of sexual love and the love of society.

19 There is also a link of connection between sentient beings of different classes.

The same observers find that even the *different* classes of sentient beings are connected together: and while the whole of each class aim only at their own enjoyment, they contribute, in some way or other, to the well-being of the other classes. Even man, the selfish lord

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(A) M. de la Metherie, editor of the *Journal de Physique*. See his prefaces to the volumes for 1792 and 1793, January and July.

lord of this sublunary world, is not the unconnected inhabitant of it. He cannot, in every instance, reap all the fruits of his situation, without contributing to the enjoyment of thousands of the brute creation. Nay, it may be proved to the satisfaction of every intelligent man, that while one race of animals, in consequence of its peculiar propensities, subsists by the destruction of another, the sum total of animal life and enjoyment is prodigiously increased. See a very judicious dissertation on this curious and puzzling subject, entitled *A Philosophical Survey of the Animal Creation;* where it appears that the increase of animal life and enjoyment which is produced by this means, beyond what could possibly obtain without it, is beyond all conception. See likewise the last edition of *King's Origin of Evil*, by Dr Law, late bishop of Carlisle.

20 The end of this connection is the accumulation of happiness.

Thus the whole assemblage seems connected, and jointly employed in increasing the sum total of possible happiness. This fitness of the various propensities of sentient and intelligent beings, this subserviency to a general purpose, strikes these observers as a mark of intention, evidently distinct from, and independent of, all the particular intentions, and superior to them all; and thus it irresistibly leads them to infer the existence of a SUPREME MIND, directing the whole of this INTELLECTUAL SYSTEM, while the individuals of which it consists appear the unconscious instruments in the hand of a great Artist, with which he executes his grand and beneficent purposes.

21 All nature, animate and inanimate, and unthinking, is connected.

But the observation goes yet further. The bodies of the inanimate creation are not only connected with each other by a mutual dependence of properties, and the relation of causation, but they are also connected with the sentient beings by a subserviency to their purposes of enjoyment. The philosopher observes that this connection is admirably kept up by the constancy of natural operations and the expectations of intelligent beings. Had either of these circumstances been wanting, had either the operations of nature been without rule, or had sentient beings no perception or expectation of their uniformity; the subserviency would be totally at an end. This adjustment, this fitness, of which the effect is the enjoyment of the sentient inhabitants of the universe, appear to be the effect of an intention of which this enjoyment is the final cause. This constancy, therefore, in the operations of nature, both in the intellectual and material world, and the concomitant expectation of sentient beings, appear the effects of *laws* imposed on the different parts of the universe by the Supreme Mind, who has formed both these classes of beings so admirably suited to each other.

22 The origin of natural theology.

To such observers the world appears a WORK OF ART, a system of means employed for gaining certain proposed ends, and it carries the thoughts forward to an ARTIST; and we infer a degree of skill, power, and good intention in this Artist, proportioned to the ingenuity, extent and happy effect which *we are able to discern* in his works. Such a contemplation of nature therefore, terminates in NATURAL THEOLOGY, or the discovery of the existence and attributes of GOD.

23 Our mode of reasoning on the operations of God.

Our notions of this *Supreme Mind* are formed from the indications of design which we observe, and which we interpret in the same way as in the actions of men. These notions, therefore, will differ from our notions of other minds only in the *degrees* which *we are able* to observe, and which we assign to these faculties; for the phenomenon or the effect is not only the mark, but also the measure of its supposed cause. These degrees must be ascertained by our own capacity of appreciating the extent, the multiplicity, and the variety of the contrivance. Accordingly, the attributes of the Supreme Mind, in the theological creed of a rude Indian, are much more limited than in that of a European philosopher. In proportion as our understandings are enlarged, and as our acquaintance with the operations of nature around us is extended, we shall perceive higher degrees of power, of skill, and of kind intention: and since we find that the scene of observation is unbounded, we cannot affix any boundaries to these attributes in our own imagination, and we are ready to suppose that they are infinite or unbounded *in their own nature*. When our attentive survey of *this* universe, and a careful comparison of all its parts, as far as we can understand or appreciate them, have made us conclude that it is *one* design, the work of *one Artist;* we are under the necessity of inferring, that, with respect to *this universe*, his power, wisdom, and benevolence, are indeed infinite.

24 The system of nature is governed by general laws.

When men have been led to draw this conclusion from the appearances of fitness which are observed everywhere around them, they consider that constancy which they observe in natural operations, whether in the material or the intellectual system, and that expectation of, and confidence in, this constancy, which renders the universe a source of enjoyment to its sentient inhabitants, as the consequences of laws imposed by the Almighty Artist on his works, in the same manner as they would consider the constancy in the conduct of any people as the consequences of laws promulgated and enforced by the supreme magistrate.

25 The nature and progress of the study of mind.

There can be no doubt of this view of nature being extremely captivating, and likely to engage the curiosity of speculative men; and it is not surprising that the phenomena of mind have been keenly studied in all ages. This part of the study of nature, like all others, was first cultivated in subserviency to the wants of social life; and the general laws of moral sentiment were the first phenomena which were considered with attention. This gradually ripened into a regular system of moral duty, accompanied by its congenial study, the investigation or determination of the *summum bonum*, or the constituents of human felicity; and these two branches of intellectual science were always kept in a state of association by the philosophers of antiquity. Jurisprudence, the science of government, legislation, and police, were also first cultivated as arts, or at least in immediate subserviency to the demands of cultivated society; and all these so nearly related parts of the study of human nature, had made a very considerable progress, in the form of maxims or precepts for directing the conduct, before speculative men, out of mere curiosity, treated them as subjects of philosophical study. Our moral sentiments, always involving a feeling of obligation, are expressed in a language considerably different from the usual language of pure philosophy, speaking of things which *ought to be*, rather than of things which *are;* and this distinction of language was increased by the very aim of the writers,

26 The rise of moral sentiments and of moral duty.

which was generally to influence the conduct as well as the opinions of their scholars. It was reserved for modern times to bring this study into the pure form of philosophy, by a careful attention to the phenomena of moral sentiment, and classing these according to their generality, and ascertaining their respective ranks by an appeal to experiment, that is, to the general conduct of mankind: and thus it happens that in the modern treatises on ethics, jurisprudence, &c. there is less frequent reference made to the *officia* or duties, or to the constituents of the *summum bonum*, than among the ancients, and a more accurate description of the human mind, and discrimination of its various moral feelings.

27
The origin of logic and other intellectual sciences.

It was hardly possible to proceed far in these disquisitions without attending to the powers of the understanding. Differences of opinion were supported by reasonings, or attempts to reasoning. Both sides could not be in the right, and there must be some court of appeals. Rules of argumentation behoved to be acquiesced in by both parties: and it could hardly escape the notice of some curious minds, that there were rules of truth and falsehood as well as of right and wrong. Thus the human *understanding* became an object of study, first in subserviency to the demands of the moralists, but afterwards for its own sake; and it gradually grew up into the science of logic. Still further refinement produced the science of metaphysics, or the philosophy of universals. But all these were *in fact* posterior to the doctrines of morals; and disquisitions on beauty, the principles of taste, the precepts of rhetoric and criticism, were the last additions to the study of the phenomena of mind. And now, since the world seems to have acquiesced in the mode of investigation of general laws by experiment and observation, and to agree that this is all the knowledge that we can acquire of any subject whatever, it is to be expected that this branch of philosophical discussion will attain the same degree of improvement (estimated by the coincidence of the doctrines with fact and experience) that has been attained by some others.

28
The partial practice of natural philosophy preceded its study as a science.

The occupations, however, of ordinary life have oftener directed our efforts towards material objects, and engaged our attention on their properties and relations; and as all sciences have arisen from arts, and were originally implied in the maxims and precepts of those arts, till separated from them by the curious speculatist, the knowledge of the material system of nature was possessed in detached scraps by the practitioners in the various arts of life long before the *natural philosopher* thought of collecting them into a body of scientific doctrines. But there have not been wanting in all ages men of curiosity who have been struck by the uniformity of the operations of nature in the material world, and were eager to discover their causes.

Accordingly, while the moralists and metaphysicians turned their whole attention to the phenomena of mind, and have produced the sciences of pneumatology, logic, ethics, jurisprudence, and natural theology, these observers of nature have found sufficient employment in considering the phenomena of the material world.

29
The nature of the material system, with the definition of that and other terms.

The bodies of which it consists are evidently connected by means of those properties by which we observe that they produce changes in each other's situation. This assemblage of objects may therefore be justly called a system. We may call it the MATERIAL SYSTEM. It is frequently termed NATURE; and the terms NATURAL APPEARANCES, NATURAL CAUSES, NATURAL LAWS, have been generally restricted to those which take place in the material system. This restriction, however, is improper, because there is no difference in the manner in which we form our notions of those laws, and reason from them, both with respect to mind and body. Or if there is to be any restriction, and if any part of the study of the universe is to be excluded in the application of these terms, it is that part only which considers moral obligation, and rather treats of what *ought to be* than of what *is*. As has been already observed, there is a considerable difference in the language which must be employed; but still there is none in the principles of investigation. We have no proof for the extent of any moral law but an appeal to the feelings of the hearts of men, indicated by the general laws or facts which are observed in their actions.

30
The unrestricted sense in which some of these terms are used, and its bad consequences.

But this is only a question of the propriety of language. And no great inconvenience would arise from the restriction now mentioned if it were scrupulously adhered to; but unfortunately this is not always the case. Some authors use the term *natural law* to express *every* coincidence of fact; and this is certainly the proper use of the term. The French writers generally use the term *loy physique* in this enlarged sense. But many authors, misled by, or taking advantage of, the ambiguity of language, after having established a law founded on a copious and perhaps unexcepted induction of the phenomena of the material system (in which case it must be considered in its restricted sense), have, in their explanation of phenomena, extended their principle much farther than the induction on which they had founded the existence of the physical law. They have extended it to the phenomena of mind, and have led their followers into great and dangerous mistakes. Languages, like every other production of human skill, are imperfect. They are deficient in terms, and are therefore figurative. The most obvious, the most frequent, and the most interesting uses of language, have always produced the appropriated terms, and the progress of cultivation has never completely supplied new ones. There are certain analogies or resemblances, or certain associations of ideas, so plain, that a term appropriated to one very familiar object will serve to suggest another analogous to it, when aided by the concomitant circumstances of the discourse; and this with sufficient precision for the ordinary purposes of social communication, and without leading us into any considerable mistakes: and it is only the rare and refined disquisitions of the curious speculatist that bring the poverty and imperfection of language into view, and make us wish for words as numerous as our thoughts. There is hardly a sentence, even of common discourse, in which there are not several figures either of single words or of phrases; and when very accurate discrimination is required, it is almost impossible to find words or phrases to express distinctions which we clearly feel. We believe it impossible to express, by the scanty vocabulary of the Hebrews, the nice distinctions of thought which are now familiar to the European philosopher. In nothing does this imperfection of language appear so remarkably as in what relates to mind. Being a late subject of separate discussion, and interesting only to a few speculatists, we have no appropriated vocabulary for it; and all our disquisitions concerning its operations are in continual metaphor or figure, depending on very slight analogies or resemblances to the phenomena of the material world. This makes the utmost caution necessary; and it justifies the British philosophers, who have been the most successful in prosecuting the study of the intellectual system, for having, almost without exception, restricted the terms, natural laws, natural causes, natural philosophy, and such like, to the material system. With us pneumatology makes no part of physics. And we may venture to affirm, that the sciences have fared better by the restriction of the terms. In no country has the spirit of liberal discussion been more encouraged and indulged than in Britain; and her philosophers have been equally eminent in both branches of science. Their performances in ethics, jurisprudence, and natural theology, are considered by all our neighbours as the fountains of knowledge on these subjects; and Locke and Clarke are names no less familiar on the continent than Newton. The licentious and degrading doctrines of the Gallican school have as yet made little impression here; and man is still considered among us as a glorious creature, born to, and fitted for, the noblest prospects.

31 The term *physics* defined as it is generally understood in Britain.

Physics, then, is with us the study of the material system, including both natural history and philosophy. The term is not indeed very familiar in our language; and in place of *physicus* and *disciplina physica*, we more generally use the terms *naturalist* and *natural knowledge*. The term *natural philosophy*, in its common acceptation, is of less extent. The field of physical investigation is still of prodigious extent; and its different quarters require very different treatments, make very different returns, and accordingly have engaged in their particular cultivation persons of very different talents and tastes. It is of some importance to perceive the distinctions, and to see how the wants and propensities of men have led them into the different paths of investigation; for, as has been more than once observed, all sciences have sprung from the humble arts of life, and both go on improving by means of a close and constant correspondence.

32 The phenomena of the material system arranged into two classes.

All the phenomena of the material system may be arranged into two classes, distinguished both by their objects and by the proper manner of treating them.

The first class comprehends all the appearances which are exhibited in the *sensible motions* of bodies, and their actions on each other producing *sensible motion*.

The second class comprehends the appearances which are exhibited in the *insensible* motions and actions of the invisible particles of matter.

33 Examples of those of the first class,

Of the phenomena of the first class we have examples in the planetary motions, the motions of heavy bodies, the phenomena of impulse, the motions and actions of machines, the pressure and motions of fluids, the sensible actions of magnetical and electrical bodies, and the motions of light.

34 and of those of the second.

We have examples of the second class in the phenomena of heat and mixture, and those exhibited in the growth of animals and vegetables, and many phenomena of solid, fluid, magnetical, electrical, and luminous bodies, in which no change of place can be observed.

35 This arrangement is apparently natural.

Thus it appears that there is a distinction in the phenomena sufficiently great to warrant a division of the study, and to make us expect a more rapid improvement by this division. Nay, the division has been made by nature itself, in the acquaintance which men have attained with her operations without study, before science appeared, and while art constituted all our knowledge.

36 Of the progress of knowledge in rude ages.

Before man had recourse to agriculture as the most certain means of procuring subsistence, our acquaintance with external substances was principally that of the natural historian; consisting of a knowledge of their fitness for food, medicine, or accommodation, their places of growth or habitation, and the means of procuring them, depending on their manner of life or existence. It required a studied attention to these circumstances to give rise to agriculture, which therefore generally made its appearance after men had been in the practice of keeping flocks; by which means they were more at their ease, and had some leisure to attend to the objects around them, and in particular to those circumstances of soil and weather which affected the growth of their pasture.

37 The origin of agriculture, physic, surgery, and chemistry,

When agriculture and a rude medicine were thus established, they were the first *arts* which had their foundation in a *system of laws*, by which the operations of nature were observed to be regulated; and with these arts we may begin the *general study of nature*, which was thus divided into two different branches.

The rude physician would be at first a collector of *specifics*; but by degrees he would observe resemblances among the *operations* of his drugs, and would class them according to these resemblances. He would thus come to attend less to the drug than to its mode of operation; and would naturally speculate concerning the connection between the operation and the economy of animal life. His art now becomes a scientific system, connected by principle and theory, all proceeding on the observation of changes produced by one kind of matter on another, but all out of sight. The frequent recourse to the vegetable kingdom for medicines would cause him to attend much more minutely to the few plants which he has occasion to study than the husbandman can do to the multitude he is obliged to rear. The physician must learn to think, the husbandman to work. An analogy between the economy of animal and vegetable life could hardly fail to engage the attention of the physician, and would make him a botanist, both as a classifier of plants and as a philosopher.

He would naturally expect to unite the services of his drugs by combining them in his recipes, and would be surprised at his disappointments. Curious and unexpected changes would frequently occur in his manipulations: the sensible qualities, and even the external appearances of his simples, would be often changed, and even inverted by their mixture; and their medicinal properties would frequently vanish from the compound, and new ones be induced. These are curious, and to him interesting facts; and he would naturally be inquisitive after

ter the principles which regulate these changes. His skill in this would by degrees extend beyond the immediate use for the knowledge; and the more curious speculatist would lay the foundations of a most extensive and important science, comprehending all the phenomena of heat and mixture.

Along with this, and springing from the same source, another science must arise, contemplating the appearances of animal and vegetable life, and founded on a careful observation and accurate description of the wonderful machine. The most incurious of men have in all ages been affected by the displays of wisdom and contrivance in the bodies of animals, and immediately engaged in investigation into the uses and functions of their various parts and organs. The phenomena have been gradually discriminated and arranged under the various heads of nutrition, concoction, secretion, absorption, assimilation, rejection, growth, life, decay, disease, and death; and, in conformity to the doctrines which have with greater or less evidence been established on these subjects, the action of medicines, and the whole practice of physic and surgery, has been established in the form of a liberal or scientific art.

38 **The origin of the knowledge of the mechanical powers.**

The husbandman in the mean time must labour the ground which lies before him. He, too, is greatly interested in the knowledge of the vegetable economy, and forms some systems on the subject by which he regulates his labours: but he sees, that whatever is the nature of vegetable life, he must work hard, and he searches about for every thing which can tend to diminish his labour. The properties of the lever, the wedge, and the inclined plane, soon become familiar to him; and without being able to tell on what their efficacy depends, he uses them with a certain sagacity and effect. The strength of timber, the pressure and force of water, are daily seen and employed by him and other artisans who labour for their mutual accommodation; and some rude principles on these subjects are committed to memory. Many tools and simple machines are by this time familiar; and thus the *general* properties of matter, and the general laws of the actions of bodies on each other, become gradually matter of observation and reflection; and the practical mechanic will be frequently improving his tools and machines. The general aim is to produce a greater quantity of work by the same exertion. The attempts to improvement will be awkward, and frequently unsuccessful. When a man finds, that by increasing the length of his lever he increases his power of overcoming a resistance, a small degree of curiosity is sufficient to make him inquire in what proportion his advantage increases. When he finds that a double length gives him a double energy, he will be suprised and mortified to find, that at the end of the day he has not performed twice the quantity of work: but, after much experience, he will learn that every increase of energy, by means of a machine, is nearly compensated by an increase of time in the performance of his task; and thus one of the great and leading principles of practical mechanics was inculcated in a manner not to be forgotten, and the practical mechanic was brought to speculate about motion and force, and by gradual and easy steps the general laws of simple motions were established.

39 **The origin of mathematics.**

It is evident that these speculations cannot be carried on, nor any considerable knowledge acquired, without some acquaintance with the art of measurement: and the very questions which the mechanic wishes to solve, presuppose some advances in this art, which in process of time refined itself into mathematics, the most perfect of all the sciences. All the phenomena of sensible motion afford employment to the mathematician It is performed in a double or triple time, through a double or triple space, by a double or triple body, by the exertion of a double or triple force, produces a double or triple effect, is more to the right or to the left, upwards or downwards, &c. In short, every affection of motion is an object of mathematical discussion. Such a science must have appeared ere now in the form of an art, in consequence of the mutual transactions of men. These among an uncultivated people are chiefly in the way of barter. If I want corn from a peasant, and have nothing to give for it but the cloth which I have made, we must fall on some way of adjusting our terms in respect of the quantity. We should soon discover that the length, and breadth, and depth, of the box or bag, were equally important; and it was not difficult to see that if any of them were doubled or tripled, the quantity of grain would be so too; if two of them were doubled, the grain would be quadrupled; and if all the three were doubled the quantity of grain would be increased eight times: the same thing would be observed with respect to my cloth. By such transactions as these, a few of the properties of plane and solid numbers and figures would become known, and the operations of multiplication and division, where arithmetic is combined with geometry: and daily observation shows us, that the more abstruse properties of number and figure, which to the generality of mankind are so insignificant, lay hold on the fancy of some individuals with such force, as to abstract them from every other intellectual entertainment, and are studied with a keenness and perseverance almost unequalled in any other walk of science. To most men the performance of a machine is a more attractive object than the properties of a figure, and the property of a figure more entertaining than that of a number; but the fact seems to have been otherwise. Before Pythagoras had invented the theorem that bears his name (see PHILOSOPHY, N° 15. and note H), and which is among the first elements of geometry, he had reformed the Grecian music by the addition of a note to their scale, and this addition proceeds on a very refined speculation on the properties of numbers; so that among the Greeks arithmetic must have made considerable progress, while geometry was yet in its cradle; and we know to what astonishing length they prosecuted the science of pure geometry, while their knowledge of mechanical principles was almost nothing. Also the Arabs hardly made any addition to the geometry of the Greeks, if they did not rather almost completely forget it; whilst they improved their arithmetic into algebra, the most refined and abstracted branch of human knowledge. There is such a distance, in point of simplicity, between pure mathematics and the most elementary mechanics, that the former continued to make rapid steps to improvement in more modern times, while the latter languished in its infancy, and hardly deserved the name of science till very lately, when the great demand for it, by the increase and improvement in manufactures, both interested many in the study, and facilitated its progress, by the multitude of machines which were contriving on all hands by the manufacturers and artisans: and even at present it must be acknowledged, that it is to them that we are indebted for almost every new invention in mechanics, and that the speculatist seldom has done more than improve the invention, by exhibiting its principles, and thus enabling the artist to correct its imperfections; and now science and art go hand in hand, mutually giving and receiving assistance. The demands of the navigator for mathematical and astronomical knowledge have dignified these sciences; and they are no longer the means of elegant amusement alone, but merit the munificence of princes, who have erected observatories, and furnished voyages of discovery, where the mathematical sciences are at the same time cherished and applied to the most important purposes.

This short sketch of what may be called *the natural history of physical sciences* will not, we hope, be thought improper or unprofitable. It tends to confirm an assertion often alluded to, that the prosecution of the study of nature will be more successful, if we imitate her mode of proceeding, and divide the labour. It will be still further confirmed by attending to the scientific difference of the phenomena, which marks out a different mode of proceeding, and a difference in the knowledge which we shall ultimately acquire, after our most successful researches.

40 The connecting principle of concomitant events is totally unknown.

In both classes of phenomena already distinguished (N° 6.) we must grant, that the principle which connects the pairs of concomitant events, rendering the one the inseparable companion of the other, is totally unknown to us, because it is not the immediate object of our perception.

41 In the first class, however, the exertion of this principle may be accurately observed,

But in the phenomena of the first class, we see the *immediate* exertion of this principle, whatever it may be; we can observe the exertion with accuracy; we can determine its kind and degree, which are the signs and measures of the kind and degree of the unperceived cause. This exertion, being always some modification of motion, allows us to call in the aid of mathematical knowledge, and thus to ascertain with the precision peculiar to that science the energy of the cause, judging of the tendency and quantity by the tendency and the quantity of the observed effect.

42 but not in the second:

But in the second class of phenomena the case is very different. In the operations of chemistry, for instance, the *immediate* exertion of the cause is not perceived: all that we observe is the assemblage of particles which obtains before mixture, and that which takes place when it is completed, and which we consider as its result. The procedure of nature in producing the change is unseen and unknown. The steps are hid from our observation. We are not only ignorant of the cause which determines one particle of our food to become a part of our body while others are rejected, but we do not see the operation. We are not only ignorant of the cause which determines a particle of vitriolic acid to quit the fossil alkali with which it is united in Glauber salt, and to attach itself to a particle of magnesia already united with the muriatic acid, which also quits it to unite with the alkali, but we do not see the operation. The particles and their motions are not the objects of our senses; and all that we see is the Epsom salt and common salt separated from the water in which we had formerly dissolved the sal mirabile and the muriated magnesia. The motions, which are the *immediate* effects of the changing causes, and therefore their *only indications, characteristics and measures*, fitted to show their nature, are hid from our view.

43 And therefore the phenomena of the second class are less understood.

Our knowledge therefore of these phenomena must be less perfect than that of the phenomena of the former class; and we must here content ourselves with the discovery of more remote relations and remote causes, and with our ignorance of the very powers of nature by which these changes are brought about, and which are cognoscible only by their immediate effects, viz. the motions which they produce unseen. The knowledge which we do really acquire is somewhat similar to what the mechanical philosopher has acquired when he has discovered, by many experiments and investigations, that magnets attract each other by their dissimilar poles, and repel each other by their similar poles, and do not act at all on any bodies but loadstones and iron. Here we leave undiscovered all that is most curious in the phenomenon, viz. how these attractions and repulsions are produced; and even here the magnetical philosopher has the advantage of seeing the agents and the operation.

44 Though some philosophers have attempted to explain them by the doctrine of motion;

But philosophers attending to this circumstance, that, even in these cases, the changes are produced by motions, or consist in motions, however unperceived these may be, have concluded, that the laws according to which nature operates in producing these changes are similar to the laws which regulate her operations in the sensible actions of bodies, or are included in them; and that the motions, though unseen, and the moving forces, are perfectly similar. They have therefore employed similar modes of investigation, applying the laws of impulse, and calling in the aid of mathematical knowledge.

Of this we have many examples in the writings of Dr Freind, Keil, Bernouilli, Helsham, Boerhaave, Hartley, and others, who have delivered theories of fermentation, solution, precipitation, crystallization, nutrition, secretion, muscular action, nay even of sensation and intelligence, founded, as they think, on the laws of motion, and illustrated and supported by mathematical reasoning. Lord Bacon himself, that careful and sagacious distinguisher of intellectual operations, has gone into the same track in his explanation of the phenomena of fire and combustion: and Sir Isaac Newton has made several attempts of the same kind, although with peculiarities which always characterize his discussions, and make them very different from those of an inferior class.

45 but their attempts have been unsuccessful.

But the success of these philosophers has hitherto been very discouraging: indeed they had no title to expect any; for their whole trains of reasoning have proceeded on analogies which were not observed, but assumed or *supposed* without any authority. There is not that similarity in the phenomenon, or in the visible effect, which is absolutely necessary for a successful reasoning by analogy. We do not observe any local motion, any change of place, which alone enables us to reason mathematically on the subject. And to make the case desperate, this ill-founded analogy has been mixed with hypotheses completely gratuitous. Certain forms have been assigned to the particles, and certain modes of action have been laid down for them, for whose reality we have not the least argument or indication: and to complete the matter, these fancied forms and laws of action have been such as are either self-contradictory and inconsistent, or they

they have been such as, if allowed to act in a way analogous to what we observe in the sensible motions of bodies, would produce effects totally different from those which are observed. These atomical theories, as they are called, transgress every rule of philosophical discussion, and even the best of them are little better than trifling amusements. By far the greatest part of them only serve to raise a smile of pity and contempt in every person at all acquainted with mechanical philosophy. Whenever we see an author attempting to explain these hidden operations of nature by invisible fluids, by æthers, by collisions, and vibrations, and particularly if we see him introducing mathematical reasonings into such explanations—the best thing we can do is to shut the book, and take to some other subject. That we may not be thought to speak presumptuously on this occasion, we only beg leave to remind our readers, that the united knowledge of the most eminent mathematicians of Europe has not yet been able to give any thing more than an approximation to the solution of the problem of three bodies; that is, to determine with accuracy the motions of three particles of matter acting on each other in the simplest of all possible manners, viz. by forces varying as the squares of the distances inversely: and the vibrations of elastic bodies, of any but the very simplest possible forms, are to this day beyond the reach of investigation. What then should be our expectations in cases where millions of particles are acting at once, of forms unobserved, and with forces unknown, and where the object is not a determination of an average result of many, where the precise state of an individual article need not be known, but where it is this very precise state of each single particle that we want to know? What can it be but uncertainty and mistake?

46 The advantage derived in these speculations from mathematical philosophy.

Notwithstanding these discouraging circumstances, we must observe that this kind of inquiry has greatly improved of late years, along with the improvement and extension of mathematical philosophy, and since philosophers have given over their incessant attempts to explain every thing by impulse; and we need not despair of making still farther advances, if we will content ourselves with going no farther than Newton has done in his explanation of the planetary motions. He has immortalized his own name, and has added immensely to our stock of useful knowledge: yet he has stopped short at the discovery of the fact of universal gravitation; and all who have endeavoured to explain or account for this fact have only exposed themselves to pity. We may perhaps be one day able to demonstrate from the phenomena that the particles of matter have certain mutual tendencies to or from each other, exerted according to fixed or invaried rules; and from these tendencies we may be able to explain many other phenomena, and predict the consequences, with as much certainty and evidence as an astronomer calculates a future eclipse. This would be a great acquisition, and perhaps more is impossible: and the road to this has been hinted by Sir Isaac Newton, who has expressed his suspicion, that as the great movements of the solar system are regulated by universal gravitation, so the mutual actions of the particles of matter are produced and regulated by tendencies of a similar kind, *equally* but not *more* inexplicable, and of which the laws of action are to be discovered by as careful an attention to the phenomena, and by the same patient thinking, which he has employed on the planetary motions. And a beautiful introduction to this new and almost unbounded field of inquiry has been given us by the celebrated Abbé Boscovich, in his Theory of Natural Philosophy, where he has shown how such mutual tendencies, similar in every ultimate particle of matter, and modified by conditions that are highly probable, nay almost demonstrable, will not only produce the sensible forms of solidity, hardness, elasticity, ductility, fluidity, and vapour, under an inconceivable variety of subordinate appearances, and the observed laws of sensible motion, but will go far to explain the phenomena of fusion, congelation, solution, crystallization, &c. &c. &c. both in chemistry and physiology. We earnestly recommend this work to the perusal of all who wish to obtain a distinct notion of the internal constitution of natural bodies, and of the way in which the uniting forces produce their ultimate and sensible effects. Any person, possessed of a moderate share of mathematical knowledge, will be convinced that the process of nature is not very different from what he describes; and that much of what we observe must happen as he says, even although the ultimate atoms of matter are not inextended mathematical points, accompanied with attracting and repelling forces.

47 Our ignorance still great, and the probable increase of knowledge among posterity.

But we have many steps to make before we begin this study: Nature opens to us an immense volume; and we doubt not that our posterity will long find employment in the perusal, even though advancing with the eagerness and success of the last century. We have not yet arrived at the threshold in many parts of this research: In many parts of chemistry, for instance, we are as yet uncertain with respect to the phenomena themselves, which are to be the subjects of this discussion. The composition of bodies must be fully understood before we begin to speak of the forces which unite their particles, or speculate about their modes of action. As long as water was considered as an element, we were ignorant of the forces inherent in its particles; we are, perhaps, still ignorant of this; but we now know that they are extremely different from what we formerly supposed them to be. It is but in a very few, if in any, cases of chemical combination, that we even know what are the ingredients: till we know this, it is too soon to speculate about their mode of union. Our ignorance in the real events in the animal and vegetable economy is still greater. Our first task therefore is to proceed, as we are now doing, in the accurate examination and classification of the phenomena themselves; and, without attempting to bring them within the pale of mathematical philosophy, by attempting what are called mechanical explanations, let us give up the consideration of these hidden operations, and augment to the utmost our list of secondary laws of visible but remote connections. All the mechanical speculations of the honourable Robert Boyle about the sensible qualities of things are now forgotten; but his chemical experiments preserve all their value, and are frequently referred to. The same may be said of the sagacious Dr Hales, whose fanciful notions of internal conflicts, and collisons, and vibrations, derogate nothing from the value of the curious facts which he has established both in the animal and vegetable economy.

48 The particular divisions of physical science in Britain.

This distinction in the nature of the phenomena, and this difference in the nature of the knowledge which is to be acquired, and the means which are to be employed for the successful prosecution of these two branches of general physics, has occasioned a still farther restriction (at least in Britain) of the term NATURAL PHILOSOPHY. It is particularly applied to the study of the phenomena of the first class, while those of the second have produced the sciences of CHEMISTRY and PHYSIOLOGY.

Natural philosophy and chemistry have generally been made particular institutions in our seminaries of learning, but physiology has more commonly been taught in conjunction with anatomy, medicine, and botany.

The phenomena of the first class have been usually called MECHANICAL, in order to distinguish them from those observed in the operations of chemistry, and in the animal and vegetable economy; and the explanations which have been attempted of some of the last, by applying the laws observed in the phenomena of the first class, have been called *mechanical explanations*.

As this first class is evidently but a part of general physics, there is some impropriety in giving the name *natural philosophy* to a course of doctrines which is confined to these alone. Indeed at the first institution of universities, the lectures given in the *Schola Physica* were much more extensive, comprehending almost all the phenomena of the material world: but as all arts and sciences have improved most where the labour has been most divided, it was found more conducive to the advancement of knowledge that separate institutions should be founded for the studies of natural history, chemistry, physiology, &c.; and thus the phenomena, purely mechanical, and a few others in magnetism, electricity, and optics, which either were susceptible of mathematical treatment, or had little connection with the studies of chemistry and physiology, were left to the care of the professor of natural philosophy.

As the terms *chemistry* and *physiology* have been applied to two very important branches of general physics, we think that a more specific or characteristic name might be appropriated to the other, and that it might very properly be termed MECHANICAL PHILOSOPHY.

It only remains to make a few observations on the distinctive means of prosecuting the studies with success, and to point out some of the advantages which may reasonably be expected from a careful prosecution of them: and as the second branch has been fully treated under the several articles of CHEMISTRY, PHYSIOLOGY, &c. we shall confine ourselves to what is usually called NATURAL PHILOSOPHY.

49
Mechanical philosophy defined, and its principles explained.

MECHANICAL PHILOSOPHY may, in conformity with the foregoing observations, be defined, "the study of the sensible motions of the bodies of the universe, and of their actions producing sensible motions, with the view to discover their causes, to explain subordinate phenomena, and to improve art."

The principle upon which all philosophical discussion proceeds is, that *every change which we observe in the condition of things is considered by us as an effect, indicating the agency, characterising the kind, and measuring the degree, of its cause.*

In the language of mechanical philosophy, the cause of any change of motion is called a moving or changing FORCE.

The disquisitions of natural philosophy must therefore begin with the consideration of motion, carefully noticing every affection or quality of it, so as to establish marks and measures of every change of which it is susceptible; for these are the only marks and measures of the changing forces. This being done, it only remains to apply them to the motions which we observe in the universe.

50
The laws of motion and their application.

From the general principle of philosophical discussion already mentioned, there flow directly two axioms.

1. *Every body perseveres in a state of rest, or of uniform rectilineal motion, unless affected by some moving force.*

2. *Every change of motion is in the direction and in the degree of the force impressed.*

These are usually called the LAWS OF MOTION. They are more properly laws of human judgment, with respect to motion. Perhaps they are necessary truths, unless it be alleged that the general principle, of which they are necessary consequences, is itself a contingent though universal truth.

By these two axioms, applied *in abstracto* to every variety of motion, we establish a system of general doctrines concerning motions, according as they are simple or compounded, accelerated, retarded, rectilineal, curvilineal, in single bodies, or in systems of connected bodies; and we obtain corresponding characteristics and measures of accelerating or retarding forces, centripetal or centrifugal, simple or compound.

We have an illustrious example of this abstract system of motion and moving forces in the first book of Sir Isaac Newton's Mathematical Principles of Natural Philosophy. Euler's *Mechanica sive Scientia Motus*, Herman's *Phoronomia sive de Viribus Corporum*, and D'Alembert's *Traité de Dynamique*, are also excellent works of the same kind. In this abstract system no regard is paid to the casual differences of moving forces, or the sources from which they arise. It is enough to characterise a double accelerating force, for instance, that it produces a double acceleration. It may be a weight, a stream of water, the pressure of a man; and the force, of which it is said to be double, may be the attraction of a magnet, a current of air, or the action of a spring.

Having established these general doctrines, the philosopher now applies them to the *general* phenomena of the universe, in order to discover the nature of the forces which really exist, and the laws by which their operations are regulated, and to explain interesting but subordinate phenomena. This is the chief business of the mechanical philosopher; and it may with some propriety be called *the mechanical history of nature*.

51
Of the arrangement of the mechanical phenomena of the universe.

Some method must be followed in this history of mechanical nature. The phenomena must be classed by means of their resemblances, which infer a resemblance in their causes, and their classes must be arranged according to some principle. We have seen no method which appears to us less exceptionable than the following.

52
The generality of the phenomena is the principle of arrangement.

The principle of arrangement is the generality of the phenomena; and the propriety of adopting this principle, arises from the probability which it gives us of more readily discovering the most general actuating forces, whose agency is implicated in all other phenomena of less extent; and therefore should be previously discussed, that we may detect the discriminating circumstances which serve to characterise the subordinate phenomena, and are thus the marks of the distinguishing and inferior natural powers.

53
The laws of motion are first applied to astronomical phenomena.

The most general of all phenomena is the curvilinear motion of bodies in free space; it is observed through the whole extent of the solar system.

The mechanical history of nature begins therefore with astronomy. Here, from the general phenomena of the planetary motions, is evinced the *fact* of the mutual deflection of every body towards every other body, and this in the inverse proportion of the squares of the distance, and the direct proportion of the quantity of matter. This is the fact of UNIVERSAL GRAVITATION, indicating the agency, and measuring the intensity, of the universal force of mutual gravity.

Having established this as an universal fact, the natural philosopher proceeds to point out all the particular facts which are comprehended under it, and whose peculiarities characterise the different movements of the solar system. That is, in the language of philosophy, he gives a theory or explanation of the subordinate phenomena; the elliptical motions of the planets and comets, their mutual disturbances; the lunar irregularities; the oblate figure of the planets; the nutation of the earth's axis; the precession of the equinoxes; and the phenomena of the tides and trade winds: and he concludes with the theory of the parabolic motion of bodies projected on the surface of this globe, and the motion of pendulums.

54
The application of this science to the arts of life.

As he goes along, he takes notice of the applications which may be made to the arts of life of the various doctrines which are successively established; such as chronology, astronomical calculation, dialling, navigation, gunnery, and the measuring of time.

55
The nature of gravitation,

If a square parcel of sand be lying on the table, and the finger be applied to any part of it to push it along the table, that part is removed where you will, but the rest remains in its place; but if it is a piece of sand-stone of the same materials and shape, and the finger is applied as before, the whole is moved; the other parts accompany the part impelled by the finger in all its motions.

56
and of cohesion.

From the moon's accompanying the earth in all its motions round the sun, we infer a moving force which connects the moon and earth. In like manner, we must conclude that a moving force connects the particles of the stone; for we give the name *force* to every thing which produces motion: We call it the force of COHESION; a term which, like gravitation, expresses merely a fact.

This seems to be the next phenomenon of the universe in point of extent.

57
Mode of investigating the laws of cohesion.

Having, from the general phenomenon, established the existence of this force, the philosopher proceeds to ascertain the laws by which its exertions are regulated; which is the ascertaining its distinctive nature and properties. This he does in the same way that he ascertained the nature of planetary gravitation, viz. by observing more particularly the various phenomena.

Here is opened a most extensive and varied field of observation, in which it must be acknowledged that very little regular and marked progress has been made. The variety of the phenomena, and the consequent variety in the nature of the connecting forces, appear as yet inconceivably great; and there seems little probability of our being able to detect in them all any sameness, combined with the other distinguishing circumstances, as we have done in the case of gravity. Yet we should not despair. Boscovich has shown, in the most unexceptionable manner, that although we shall suppose that every atom of matter is endued with a perfectly similar force, acting in a certain determined ratio of the small and imperceptible distances at which the particles of matter are arranged with respect to each other, the external or sensible appearances may, and must, have all that variety which we observe. He also shows very distinctly how, from the operation of this force, must arise some of the most general and important phenomena which characterise the different forms of tangible bodies.

We observe the chief varieties of the action of this CORPUSCULAR force on the bodies which we denominate *hard*, *soft*, *solid*, *fluid*, *vaporous*, *brittle*, *ductile*, *elastic*. We see instances where the parts of bodies avoid each other, and require external force to keep them together, or at certain small distances from each other. This is familiar in air, vapours, and all compressible and elastic bodies.

This is evidently a most curious and interesting subject of investigation. On the nature and action of these corpuscular forces depends the strength or firmness of solids, their elasticity, their power of communicating motion, the pressure, and motion, and impulse of fluids; nay, on the same actions depend all the chemical and physiological phenomena of expansion, fusion, congelation, vaporisation, condensation, solution, precipitation, absorption, secretion, fermentation, and animal and vegetable concoction and assimilation.

Out of this immense store of phenomena, this inexhaustible fund of employment for our powers of investigation, the natural philosopher selects those which lead directly to the production or modification of sensible motion.

He will therefore consider,

58
The production of motion by impulse has been thought the most familiar fact in nature.

1. The communication of motion among detached and free bodies, establishing the laws of impulse or collision. This has always been considered as the elementary doctrine of mechanical philosophy, and as the most familiar fact observed in the material world; and in all ages philosophers have been anxious to reduce all actions of bodies on each other to impulse, and have never thought a phenomenon completely explained or accounted for till it has been shown to be a case of impulse. This it is which has given rise to the hypotheses of vortices, ethers, magnetic and electric fluids, animal spirits, and a multitude of fancied intermediums between the sensible masses of matter, which are said in common language to act on each other. A heavy body is supposed to fall, because it is impelled by a stream of an invisible fluid moving according to certain conditions suited to the case. The filings of iron are supposed to be arranged round a magnet, by means of a stream of magnetic fluid issuing from one pole, circulating perpetually round the magnet, and entering at the other pole, in the same manner as we observe the flote-grass arranged by the current of a brook.

59
But this opinion is very questionable.

But the philosopher who has begun the mechanical study of nature by the abstract doctrines of dynamics, and made its first application to the celestial phenomena, and who has attended carefully to the many analogies between the phenomena of gravitation and cohesion, will be at least ready to entertain very different notions of this matter. He will be so far from thinking that the production of motion by impulse is the most familiar fact in nature, that he will acknowledge it to be comparatively very rare; nay, there are some appearances in the facts, which are usually considered as instances of impulsion, which will lead him to doubt, and almost to deny, that there has *ever been observed* an instance of one body putting another in motion by coming into absolute contact with it, and striking it; and he will be disposed to think that the production of motion in this case is precisely similar to what we observe when we gently push one floating magnet towards another, with their similar poles fronting each other. There will be the same production of motion in the one and diminution of it in the other, and the same uniform motion of the common centre of gravity: and, in this case of the magnets, he sees completely the necessity of a law of motion, which is not an axiom, but is observed through the whole of nature, and which receives no explanation from any hypothesis of an intervening fluid, but is even totally inconsistent with them. We mean, "that every action of one body on another is accompanied by an equal and opposite action of that other on the first." This is usually called the *equality of action and reaction*: it is not intuitive, but it is universal; and it is a necessary consequence of the perfect similarity of the corpuscular forces of the same kinds of matter. This general fact, unaccountable on the hypothesis of impelling fluids, is considered in the planetary motions as the unequivocal indication of the sameness of that gravity which regulates them all. The rules of good reasoning should make us draw the same conclusion here, that the particles of tangible matter are connected by equal and mutual forces, which are the *immediate causes* of all their sensible actions, and that these forces, like gravitation, vary with every change of distance and situation.

60
Motion seems to be produced from the equality of action and reaction.

The laws of collision and impulsion being now established, either as original facts or as consequences of the agency of equal and mutual forces which connect the particles of matter, the philosopher considers,

61
Of motion as it respects the theory of machines, &c.

2. The production of motion by the intervention of solid bodies, where, by reason of the cohesion of matter, some of the motions are necessarily confined to certain determinate paths or directions. This is the case in all motions round fixed points or axes, or along planes or curves which are oblique to the action of the forces.

62
MECHANICS.

This part of the study contains the theory of machines, pointing out the principles on which their energy depends, and consequently furnishing maxims for their construction and improvement. But these observations do not complete the discussion of the mechanism of solid bodies: they are not only solid and inert, but they are also heavy; therefore the action of gravity must be combined with the consequences of solidity. This will lead to discussions about the centre of gravity, the theory and construction of arches and roofs, the principles of stability and equilibrium, the attitudes of animals, and many particulars of this kind.

63
The nature and definition of fluidity.

3. The philosopher will now turn his attention to another form, in which tangible matter exhibits many interesting phenomena, viz. FLUIDITY. The first thing to be attended to here is, *What is that particular form of existence?* What is the precise phenomenon which characterises fluidity? What is the definition of a fluid? This is by no means an easy question, and considerable objections may be stated against any definition that has been given of it. Sir Isaac Newton says, that *a fluid is a body whose particles yield to the smallest impression, and by so yielding are easily moved among themselves.* It may be doubted whether this be sufficiently precise; what is meant by the *smallest impression?* and what is *easily* moving? Is there any precise degree of impression to which they do not yield; and do they oppose any resistance to motion? And a stronger objection may be made: It is not clear that a body so constituted will exhibit all the appearances which a body acknowledged to be fluid does really exhibit. Euler offers some very plausible reasons for doubting whether it will account for the horizontal surface, and the complete propagation of pressure through the fluid in every direction; and therefore prefers selecting *this last phenomenon*, the propagation of pressure *quâqua versum*, as the characteristic of fluidity, because a body having this constitution (on whatever circumstance it may depend) will have every other observed property of a fluid. But this definition is hardly simple or perspicuous enough; and we think that the objections against Newton's more simple and intelligible definition are not unanswerable. Boscovich defines a fluid to be, *a body whose particles exert the same mutual forces in all directions;* and shows, that such particles must be indifferent, as to any position, with respect to each other. If no external force act on them, they will remain in every position, and will have no tendency to arrange themselves in one position rather than another; differing in this respect from the particles of solid, or soft, or viscid bodies; which require some force to change their respective positions, and which recover these positions again when but gently disturbed. He illustrates this distinction very beautifully, by comparing a parcel of balls thrown on quicksilver, and attracting each other, with a parcel of magnets in the same situation. The balls will stick together, but in *any position;* whereas the magnets will always affect a particular arrangement.

64
Of the pressure and equilibrium of fluids, or hydrostatics.

When the characteristic phenomenon of fluidity has been selected, the philosopher proceeds to combine this property with gravity, and establishes the doctrines of HYDROSTATICS, or of the pressure and equilibrium of heavy fluids, the propagation of this pressure in every direction; and demonstrates the horizontality of surface assumed by all perfect fluids.

These doctrines and principles enable us to determine several very interesting circumstances respecting the mutual pressure of solids and fluids on each other; the pressures exerted on the bottoms and sides of vessels; the support and whole mechanism of floating bodies, &c.

65
Of the motion of fluids, or hydraulics.

He then considers how fluids will move when their equilibrium of pressure is destroyed; and establishes the doctrines of HYDRAULICS, containing all the modifications of this motion, arising from the form of the vessels, or from the intensity or direction of the pressure which occasions it. And this subject is completed by the consideration of the resistance which fluids oppose to the motion of solid bodies through them, and their impulse on bodies opposed to their action.

These are very important matters, being the foundations of many mechanical arts, and furnishing us with some of our most convenient and efficacious powers for impelling machines. They are also of very difficult discussion, and are by no means completely investigated or established. Much remains yet to be done both for perfecting the theories and for improving the arts which depend upon them.

66 The importance and difficulty of these branches of science.

It is evident, that on these doctrines depend the knowledge of the motions of rivers and of waves; the buoyancy, equilibrium, and stability of ships; the motion of ships through the waters; the action of the winds on the sails; and the whole arts of marine construction and seamanship.

67 The nature and definition of vapour.

There is another general form of tangible matter which exhibits very different phenomena, which are also extremely interesting; we mean that of VAPOUR. A vapour is a fluid; and all the vapours that we know are heavy fluids: they are therefore subject to all the laws of pressure and impulse, which have been considered under the article HYDRODYNAMICS. But they are susceptible of great compression by the action of external forces, and expand again when these forces are removed. In consequence of this compression and expansion, the general phenomena of fluidity receive great and important modifications; and this class of fluids requires a particular consideration. As air is a familiar instance, this branch of mechanical philosophy has been called PNEUMATICS.

68 The doctrine of air or pneumatics.

Under this head we consider the pressure of the atmosphere, and its effects, both on solid and fluid bodies. It produces the rise of waters or other fluids in pumps and syphons, and gives us the theory of their construction: it explains many curious phenomena of nature, such as the motions in the atmosphere, and their connection with the pressure of the air, and its effect on the barometer or weather-glass. Air, when in motion, is called *wind;* and it may be employed to impel bodies. The theory of its action, and of its resistance to moving bodies, are therefore to be considered in this place.

But besides their motions of progression, &c. such as we observe in winds, compressible or elastic fluids are susceptible of what may be termed *internal motion;* a kind of undulation, where the contiguous parts are thrown into tremulous vibrations, in which they are alternately condensed and rarefied; and these undulations are propagated along the mass of elastic fluid, much in the same way in which we observe waves to spread on the surface of water. What makes this an interesting subject of consideration is, that these undulations are the more ordinary causes of sound. A trembling chord, or spring, or bell, agitates the air adjoining to it: these agitations are propagated along the air, and by its intervention agitate the organ of hearing. The mechanism of these undulations has been much studied, and furnishes a very beautiful theory of musical harmony.

69 Of the compressibility of elastic fluids, and its consequence.

The philosopher examines the *law of compressibility* of air and other elastic fluids; and thus gets the knowledge of the constitution of the atmosphere, and of the action of those fluids when employed to impel solid bodies. Gunpowder contains an immense quantity of permanently elastic air, which may be set at liberty by inflammation. When this is done at the bottom of a piece of ordnance, it will impel a ball along the barrel, and discharge it from the muzzle, in the same way that an arrow is impelled by a bow. And thus having discovered in what degree this air presses in proportion to its expansion, we discover its action on the ball through the whole length of the piece, and the velocity which it will finally communicate to it. Here then is contained a theory of artillery and of mines.

70 Of the conversion of bodies into elastic fluids by fire.

Chemistry teaches us, that most bodies can be converted by fire into elastic fluids, which can be employed to act on other bodies in the way of pressure or impulse. Thus they come under the review of the mechanical philosopher; and they have become interesting by being employed as moving forces in some very powerful machines.

These discussions will nearly exhaust all the general mechanical phenomena. There remain some which are much more limited, but furnish very curious and important subjects of investigation.

71 Of the phenomena of loadstone, or magnetism.

The phenomena exhibited between loadstones or magnets and iron have long attracted attention; and the use to which the polarity of the loadstone has been applied, namely, the directing the course of a ship through the pathless ocean, has rendered these phenomena extremely interesting. They are specified by the term MAGNETISM. Considerable progress has been made in the arrangement and generalization of them; but we have by no means been able hitherto to bring them all under one simple fact. The attention has been too much turned to the discovery of the ultimate cause of magnetism; whereas we should have rather employed our ingenuity in discovering all the general laws, in the same manner as Kepler and Newton did with respect to the celestial phenomena, without troubling themselves with the cause of gravitation. Dr Gilbert of Colchester was the first who considered the magnetical phenomena in the truly philosophical manner; and his treatise *De Magnete* may be considered as the first and one of the most perfect specimens of the Baconian or inductive logic. It is indeed an excellent performance; and when we consider its date, 1580, it is a wonder. Æpinus's *Tentamen Theoriæ Magnetismi* is a most valuable work, and contains all the knowledge which we have as yet of the subject.

72 Of electrical phenomena.

There is another class of mechanical phenomena which have a considerable affinity with the magnetical; we mean the phenomena called ELECTRICAL. Certain bodies, when rubbed or otherwise treated, attract and repel other bodies, and occasion a great variety of sensible motions in the neighbouring bodies. Philosophers have paid much attention to these appearances of late years, and established many general laws concerning them. But we have not been more successful in bringing them all under one fact, and thus establishing a complete theory of them, than in the case of magnetism. Franklin and Æpinus are the authors who have been most successful in this respect. Dr Franklin in particular has acquired great celebrity by his most sagacious comparison of the phenomena; which has enabled him to establish a few general laws, almost as precise as those of Kepler, and of equally extensive influence. His discovery too of the identity of thunder and electricity has given an importance and dignity to the whole subject.

73 These are not all mechanical.

There are many phenomena of electricity which cannot be called mechanical, and are of the most curious and interesting kind. As these have little connection with any of the other great branches of physical science, they have generally been considered in treatises of natural philosophy; and, along with inquiries into the original cause of electricity in general, continue to engage much of our attention.

The appearances which are presented to us by our sense of seeing form another class, which have always been considered as making a branch of natural philosophy in all seminaries of learning. It does not, however, obviously appear, that they are mechanical phenomena.

74
Of the phenomena of vision.

The intimate nature of light is still a secret. Fortunately it is not necessary to be known to give us a very perfect theory of the chief phenomena. The general laws of optics are so few, so simple, and so precise, that our theories are perhaps more perfect here than in any other branch of physics; but these theories are as yet far removed from the rank of primary facts. Many unknown events happen before the phenomenon comes under the hands of the ordinary optician, so as to become the subjects of the simple laws of reflection and refraction.

75
It has been doubted whether light is corporeal.

It may even be doubted, and has been doubted, whether the phenomena of optics are cases of body in motion; whether all the lines which the optician draws are any thing but the directions along which certain *qualities* are exerted. The side of a ball which is next the candle may be bright and the other side dark, just as the side of a ball which is next the electrical globe is *minus* and the other side *plus;* and all this without any intervening medium. Apparition or visibility may be a quality of a body, depending on the proximity and position of another body, without any thing between them, just as weight is; and this quality may be cognizable by our faculty of seeing alone, just as the pressure of a heavy body is by our feeling alone.

76
How optics came to be considered as a part of mechanical philosophy.

The first thing which made it probable that mechanical philosophy had any thing to do with the phenomena of optics, was the discovery of Mr Roemer, "that apparition was not instantaneous;" that some time elapsed between the illumination of a body and its being seen at a distance. He discovered, that it was not till 40 minutes after the sun illuminated one of Jupiter's satellites that it was seen by the inhabitants of this globe. If therefore a sun were just created, it would be 40 minutes before Jupiter would be illuminated by him, and 200 before the Georgian planet would be illuminated.

77
The nature of light is still undetermined.

Here then is motion. It is therefore highly probable that there is something moved; but it is still doubted whether this something, which we call LIGHT, is a matter emitted from the shining body, and moving with great velocity, and acting on and affected by other bodies, in the various phenomena of optics, or whether it is a *certain state* of a medium which is thus propagated, as we see that waves are propagated along the surface of water, or sonorous undulations through the mass of air, while the water or air itself is hardly moved out of its place. Either of these suppositions makes optics a legitimate branch of mechanical philosophy; and it is the philosopher's business to examine both by the received laws of motion, and see which of them gives consequences which tally with the phenomena. This has been done; and we imagine that a complete incompatibility has been demonstrated between the consequences of the undulations of an elastic medium, and the phenomena of optics; while the consequences of the other or vulgar notion on this subject are perfectly consistent with mechanical laws. There are some things in this hypothesis very far beyond our power to conceive distinctly; but they are all similar in this respect to many facts acknowledged by all; and there is no phenomenon that is inconsistent with the legitimate consequences of the hypothesis. This gives it great probability; and this probability is confirmed by many chemical facts, and by facts in the vegetable economy, which give strong and almost undeniable indications of light being a body capable of a chemical union with the other ingredients of sublunary bodies, and of being afterwards set at liberty under its own form, as the cause or medium of vision.

78
But this does not affect the science of optics.

But these are questions similar to those about the cause of gravity, and totally unnecessary for establishing a complete theory of the optical phenomena, for explaining the nature of vision, the effects of optical instruments, the cause of colours, the phenomena of the rainbow, halos and parhelia, &c. &c. &c. Only all this theory is unconnected with the principles called mechanical.

79
The probable increase of the above extensive field of observation.

Such is the field of observation to the mechanical philosopher of the present day. We may hope to extend it, and by degrees apply its doctrines even to the unseen motions which take place in chemistry and phisiology. But we must, in the first place, perfect our knowledge and description of the sensible motions and actions of bodies. Those of fluids still demand much investigation; and till these are thoroughly understood, it is not time to attempt penetrating further into the recesses of nature.

80
Investigation of the law that action is always equal and opposite to reaction.

In the prosecution of this study, it is found that every change which can be observed in the state of a body, with respect to motion by the action of another body, is accompanied by an equal and opposite change in the state of that other body. Thus, in the phenomena of gravitation, it is observed that the deflections of the sun and planets are mutual. The same thing is observed in the actions of magnets on each other and on iron; it is also observed in the attractions and repulsions of electrical bodies; and it also obtains in all the phenomena of impulse and of corporeal pressure. It is therefore an universal law of motion, that *action is always equal and opposite to reaction:* but this must be considered merely as a matter of fact, a contingent law of nature, like that of gravitation. The contrary is perfectly conceivable, and involves no contradiction. That this is so, is evident from the proceedings of philosophers, who in every new case make it their business to discover by experiment whether this law was observed or not. It was among the last discoveries made by Sir Isaac Newton in his examination of the celestial motions. This being the case, it should never be assumed as a principle of reasoning till its operation has been ascertained by observation.

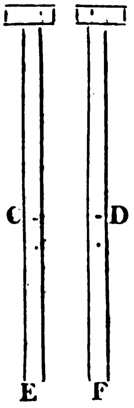
81
The term *inertia* has occasioned much wrangling and misconception on this subject.

It has been owing to this improper procedure that much false reasoning has been introduced into mechanical philosophy, and particularly into the theory of impulsion or the communication of motion by impulse. In considering this subject, a term has been introduced which has occasioned much wrangling and misconception; we mean the term INERTIA. It serves indeed to abbreviate language, but it has often misled the judgment. When used with cautious attention to every circumstance, it expresses nothing but the necessity of a cause to the production of any effect: but it is generally used as expressing a quality inherent in matter, by which it *resists* any change of state, or by which it maintains its present state. Matter is said to be inert; and as every thing which changes the motion of a body is called a *force*, and as this inertia of A is supposed to change the motion of B, it is called *vis inertiæ*; and yet matter is said to be indifferent as to motion or rest, and to be inactive. These are surely very incongruous expressions. This obscure discourse has arisen from the poverty of all languages, which are deficient in original terms, and therefore employ figurative ones. Force, action, resistance, are all appropriated terms related to our own exertions; and some resemblance between the external effects of these exertions and the effects of the connecting qualities of natural bodies, has made us use them in our disquisitions on these subjects. And as we are conscious that, in order to prevent our being pushed by another from our place, we must resist, exerting force; and that our resistance is the reason why this other man has not accomplished his purpose, we say, that the quiescent body resists being put in motion, and that its inertia is discovered by the diminution made in the motion of the impelling body: and upon the authority of this *vis inertiæ* as a first principle, the phenomena of impulsion are explained, and the law of equal action and reaction is established.

But all this procedure is in contradiction to the rules of inductive logic; and the obscurity and confusion which has arisen from this original misconception, the consequent incongruity of language, and the awkward attempts that have been made to botch and accommodate it to the real state of things, have occasioned a dispute, and the only dispute, in natural philosophy which has not yet been settled, and never can be settled, while such misconceptions are allowed to remain.

82 Its proper meaning, with an example.

If the word *inertiæ* be taken as expressing not a quality of matter, but a law of human judgment respecting matter, as expressing our necessity of inferring the agency of a moving force whenever we observe a change of motion, all difficulties will vanish, and the equality of action and reaction will be inferred, as it should be, from the phenomena of collision. There will be inferred a *vis insita corpori impellenti*, not *quâ moventi*, but *quâ corpori;* and this inference will carry us through all the mysteries of corporeal action, as it conducted Sir Isaac Newton in his grand researches.



Let us just consider how we reason in a new case. Let A and B be two magnets fastened on the ends of two long wooden laths AE, BF, which turn horizontally on pivots C, D, like compass needles, with their north poles fronting each other, 12 inches apart; and let A be pushed towards B, so that it would move uniformly with the velocity of two inches in a second. The phenomena *which have been observed* are as follow: A will gradually diminish its velocity; and when it has advanced about nine inches, will stop completely. B, in the mean time will gradually acquire motion; and when it has advanced about nine inches, will have a velocity of about two inches per second, with which it will continue to move uniformly. Now what is inferred from these phenomena? Because the motion of A is gradually retarded, we infer that a retarding force, that is, a force in the direction BA, has acted on it. And since this would not have happened if B had not been there, and always happens when B is there, we infer that B is either its cause or the occasion of its action. The vulgar say that B repels A; so say the dynamists. The abettors of invisible fluids say, that a stream of fluid issuing from B impels A in the opposite direction. All naturalists agree in saying, that an active force connected with B has destroyed the motion of A, and consider this curious phenomenon as the indication and characteristic of a discovery. The same inference is made from the motion produced in B: it is considered by all as effected by a force exerted or occasioned by the presence of A; and the dynamists and the vulgar say that A *repels* B. And both parties conclude, from the equal changes made on both bodies, that the changing forces are equal; here acknowledging, that they *observe* an equality of action and reaction; and they add this to the other instances of the extent of this law of motion.

All this while no one thinks of the inertia or inactivity of B, but, on the contrary, conclude this to be a curious instance of its activity; and most people conclude that both bodies carry about with them a *vis insita* both when at rest and when in motion.

83 It is doubtful whether actual contact has ever been observed.

If other phenomena give unquestionable evidence that in ordinary collisions, there is the same changes of motion, produced without mathematical contact, the same inferences must be drawn; and a scrupulous naturalist will doubt whether contact should make any change in our reasonings on the subject, and whether actual contact ever has been or can be observed. He will also be convinced, that while this is the general, or perhaps universal, process of nature in producing motion by impulse, all explanations of the action of bodies *è distanti*, by the intervention of ethers and other invisible fluids, are nothing but multiplying the difficulties; for in place of one fact, the approach of one magnet (for instance) to another, they substitute millions of unseen impulses, each of which equally needs an explanation. And if this fluid be supposed to produce its effects by any *peculiarity* in its constitution, as in the case of Newton's elastic ether proposed by him to explain gravitation, the hypothesis substitutes, in the most unqualified manner, millions of similar phenomena for the one to be explained; for there is the same want of a second fluid in order to produce that mutual recess of the particles of the ether which constitutes its elasticity.

84 The folly of supposing intervening ethers, &c.

85 The quality of bodies whereby they affect other bodies is inscrutable by us.

And this seems to be the limit to our inquiries into all the classes of natural phenomena. We find the masses or the particles of matter endued in fact with qualities which affect the state of other particles or masses, at smaller or at greater distances from each other according to certain general rules or laws. This ultimate step in the constitution of things is inscrutable by us. It is arrogance in the highest degree for us to say, that because we do not comprehend how there is inherent in a body any quality by which another body may be affected at any distance from it, therefore no such quality *is possible*. It is no less so to say, that matter has no active property but that of moving other matter by impulse; and that because it may be so moved, and also by the agency of our own minds, therefore, when it is not moved by impulse, it is moved by minds. The same almighty FIAT which brought a particle of matter into existence could bring those qualities equally into existence; and the *how* in both is equally beyond our comprehension.

86 This should not, however, stop further inquiries.

But, on the other hand, we must guard against the incurious resting on this consideration as a stop to further inquiry. There may be species of matter possessed

sed of the mechanical powers, and which notwithstanding is not cognisable by our senses. All the properties of matter are not known to a person who is both deaf and blind; and beings possessed of more senses may perceive matter where we do not; and many phenomena may really be produced by the action of intervening matter, which we, from indolence or from haste, ascribe to the agency of inherent forces. The industry of philosophers has already discovered intermedia in some cases. It is now certain that air is the conveyor of sound, and it is almost certain that there is such a thing as light. Let us therefore indulge conjectures of this kind, and examine the conjectures by the received laws of motion, and reject them when we find the smallest inconsistency; and always keep in mind that even the most coincident with the phenomena is still but a possibility.

87
These observations are not physical, but metaphysical.

We may conclude the whole of these observations with the remark, that these questions about the activity or inactivity of matter are not physical, but metaphysical. Natural philosophy, it is true, commonly takes it for granted that matter is wholly inactive; but it is not of any moment in physics whether this opinion be true or false; whether matter be acted on according to certain laws, or whether it act of itself according to the same laws, makes no difference to the natural philosopher. It is his business to discover the laws which really obtain, and to apply these to the solution of subordinate phenomena: but whether these laws arise from the nature of some agent external to matter, or whether matter itself is the agent, are questions which may be above his comprehension, and do not immediately concern his proper business.

88
The above account points out the best method of study.

The account we have now given of natural philosophy points out to us in the plainest manner the way in which the study must be prosecuted, and the helps which must be taken from other branches of human knowledge.

89
This method further explained and exemplified.

The causes, powers, forces, or by whatever name we choose to express them, which produce the mechanical phenomena of the universe, are not observed, and are known to us only in the phenomena themselves. Our knowledge of the mechanical powers of nature must therefore keep pace with our knowledge of the motions, and indeed is nothing different from it. In order to discover and determine the forces by which the moon is retained in her orbit round the earth, we must know her motions. To a terrestrial spectator she appears to describe an ellipse, having the earth in one focus; but, in the mean time, the earth is carried round the sun, and the moon's real path, in absolute space, is a much more complicated figure. Till we know this figure, and the variations in the velocity with which it is described, we know nothing of the forces which actuate the moon in her orbit.

90
The meaning of some terms used in speaking of the celestial motions.

When Newton says that the forces by which she is retained in this elliptical orbit are directed to the earth, what does he mean? Only this, that the deflections from that uniform rectilineal motion which she would otherwise have performed are always in this direction. In like manner, when he says that these forces are inversely proportionate to the squares of her distances from the earth, he only means that the deflections made in equal times in different parts of her motion are in this proportion. These deflections are considered as the characteristics and measures of the forces. We imagine that we have made all plain when we call this indicated cause a *tendency* to the earth; but we have no notion of this tendency to the earth different from the approach itself. This word tendency, so fashionable among the followers of Sir Isaac Newton, is perverted from its pure and original sense. *Tendere versus solem*, is, in the language of Rome and also of Newton, *to go* towards the sun; but we now use the words *tend*, *tendency*, to signify, not the *approach*, but the *cause* of this approach. And when called upon to speak still plainer, we desert the safe paths of plain language, and we express ourselves by metaphor; speaking of *nisus*, *conatus sese mutua accedende*, *vis centripeta*, &c. When these expressions have become familiar, the original sense of the word is forgotten, and we take it for granted that the words never had another meaning; and this metaphor, sprung from the poverty of language, becomes a fruitful source of misconception and mistake. The only way to secure ourselves against such mystical notions as are introduced by these means into philosophy, is to have recourse to the way in which we acquire the knowledge of these fancied powers; and then we see that their names are only names for phenomena, and that universal gravitation is only an universal mutual approach among the parts of the solar system.

91
The absurdity of reasoning *à priori*.

There is one case in which we fondly imagine that we know the cause independent of the effect, and that we could have predicted the phenomenon *à priori*; we mean the case of impulse: and hence it is that we are so prone to reduce every thing to cases of impulsion, and that we have fallen upon all these subterfuges of ethers and other subtile fluids. But we might have saved ourselves all this trouble; for after having, by much false reasoning and gratuitous assumptions, shown that the phenomenon in question *might have been produced* by impulse, we are no nearer our purpose, because that property by which matter in motion puts other matter in motion, is known to us only *by* and *in* the effect.

92
We know nothing of the immediate causes of motions except by a knowledge of the motions themselves.

The fair and logical deduction from all this is, that we must not expect any knowledge of the powers of nature, the immediate causes of the motions of bodies, but by means of a knowledge of the motions themselves; and that every mistake in the motions is accompanied by a similar mistake in the causes. It is impossible to demonstrate or explain the gravitation of the planets to him who is ignorant of the properties of the ellipse, or the theory of gunnery to him who does not know the parabola.

93
A man cannot be a good natural philosopher without being a mathematician.

A notion has of late gained ground, that a man may become a natural philosopher without mathematical knowledge; but this is entertained by none who have any mathematics themselves; and surely those who are ignorant of mathematics should not be sustained as judges in this matter. We need only appeal to fact. It is only in those parts of natural philosophy which have been mathematically treated, that the investigations have been carried on with certainty, success, and utility. Without this guide, we must expect nothing but a school-boy's knowledge, resembling that of the man who takes up his religious creed on the authority of his priest, and can neither give a reason for what he imagines that he believes,

lieves, nor apply it with confidence to any valuable purpose in life. We may read and be amused with the trifling or vague writings of a Nollet, a Ferguson, or a Priestley; but we shall not understand, or profit by the truths communicated by a Newton, a D'Alembert, or De la Grange.

These observations, on the other hand, show us the nature of the knowledge which may be acquired, and the rank which natural philosophy holds among the sciences.

94 The motions of bodies the only objects of observation, are subjects of pure mathematical disquisition.

Motions are the real and only objects of our observation, the only subjects of our discussion. In motion are included no ideas but those of space and time, the subjects of pure mathematical disquisition. As soon, therefore, as we have discovered the fact, the motion, all our future reasonings about this motion are purely mathematical, depending only on the affections of figure, number, and proportion, and must carry along with them that demonstration and irresistible evidence which is the boast of that science. To this are we indebted for that accuracy which is attained, and the progress which has been made, in some branches of mechanical philosophy; for when the motions are distinctly and minutely understood, and then considered only as mathematical quantities, independent of all physical considerations, and we proceed according to the just rules of mathematical reasoning, we need not fear any intricacy of combination or multiplicity of steps; we are certain that truth will accompany us, even though we do not always attend to it, and will emerge in our final proposition, in the same manner as we see happen in a long intricate algebraic analysis.

95 Mechanical philosophy thus cultivated is a demonstrative science.

96 The lamentable decay of mathematics in Britain,

97 notwithstanding the amplest encouragement from the crown.

Mechanical philosophy, therefore, which is cultivated in this way, is not a system of probable opinions, but a *disciplina accurata*, a demonstrative science. To possess it, however, in this form, requires considerable preparation. The mere elements of geometry and algebra are by no means sufficient. Newton could not have proceeded *sine* "*sua mathesi facem preferente*;" and, in creating a new science of physics, he was obliged to search for and discover a new source of mathematical knowledge. It is to be lamented that the taste for the mathematical sciences has so prodigiously declined in this country of late years; and that Britain, which formerly took the lead in natural philosophy, should now be the country where they are least cultivated. Few among us know more than a few elementary doctrines of equilibrium: while, on the continent, we find many authors who cultivate the Newtonian philosophy with great assiduity and success, and whose writings are consulted as the fountains of knowledge by all our countrymen who have occasion to employ the discoveries in natural philosophy in the arts of life. It is to the foreign writers that we have recourse in our seminaries, even for elementary treatises; and while the continent has supplied us with most elaborate and useful treatises on various articles, in physical astronomy, practical mechanics, hydraulics, and optics, there has not appeared in Britain half a dozen treatises worth consulting for these last forty years; and this notwithstanding the unparalleled munificence of our present sovereign, who has given more liberal patronage to the cultivators of mathematical philosophy, and indeed of science in general, than any prince in Europe. The magnificent establishments of Louis XIV. originated from his insatiable ambition and desire of universal influence, directed by the sagacious Colbert. And his patronage being exerted according to a regular plan in the establishment of pensioned academics, and in procuring the combined efforts of the *most eminent* of all countries, his exertions made a conspicuous figure, and filled all Europe with his eulogists. But all this was done without the smallest self-denial, or retrenchment of his own pleasures, the expences being furnished out of the public revenues of a great and oppressed nation; whereas the voyages of discovery, the expensive observations and geodetical operations in Britain, and the numberless unheard-of pensions and encouragements given to men of science and activity, were all furnished out of the private estate of our excellent sovereign, who seems to delight in repaying, by every service in his power, the attachment of a loyal and happy nation. It is therefore devoutly to be wished that his patriotic efforts were properly seconded by those whom they are intended to serve, and that the taste for the mathematical sciences may again turn the eyes of Europe to this country for instruction and improvement. The present seems a most favourable era, while the amazing advances in manufactures of every kind seem to call aloud for the assistance of the philosopher. What pleasure would it have given to Newton or Halley to have seconded the ingenious efforts of a Watt, a Boulton, a Smeaton, an Arkwright, a Dollond? and how mortifying is it to see them indebted to the services of a Belidor, a Bossut, a Clairaut, a Boscovich?

We hope to be pardoned for this digression, and return to our subject.

98 Mechanical philosophy is almost wholly a mathematical study.

99 Experiments are, however, necessary to insure the attention of young minds.

It appears from what has been said, that mechanical philosophy is almost wholly a mathematical study, and that it is to be successfully prosecuted only under this form: but in our endeavours to initiate the young beginner, it will be often found to require more steadiness of thought than can generally be expected for keeping the mind engaged in such abstract speculations. The object presented to the mind is not readily apprehended with that vivacity which is necessary for enabling us to reason upon it with clearness and steadiness, and it would be very desirable to have some means of rendering the conception more easy, and the attention more lively. This may be done by exhibiting to the eye an experiment, which, though but a single fact, gives us a sensible object of perception, which we can contemplate and remember with much more steadiness than any mere creature of the imagination. We could, by an accurate description, give such a conception of a room that the hearer should perfectly comprehend our narration of any occurrence in it: but one moment's glance at the room would be infinitely better. It is usual therefore to employ experiments to assist the imagination of the beginner; and most courses of natural philosophy are accompanied by a series of such experiments. Such experiments, connected by a slight train of argumentative discourse, may even serve to give a notion of the general doctrines, sufficient for an elegant amusement, and even tending to excite curiosity and engage in a serious prosecution of the study. Such are the usual courses which go by the name of experimental philosophy: but this is a great misapplication of the term; such courses are little more than *illustrations* of known doctrines by experiments.

100 Experimental philosophy defined and explained.

EXPERIMENTAL PHILOSOPHY is the investigation of general laws, as yet unknown, by experiment; and it has been observed, under the article PHILOSOPHY, that this is the most infallible (and indeed the sole) way of arriving at the knowledge of them. This is the *Novum Organum Scientiarum* strongly recommended by Lord Bacon. It was new in his time, though not altogether without example; for it is the procedure of nature, and is followed whenever curiosity is excited. There was even extant in his time a very beautiful example of this method, viz. the Treatise of the Loadstone, by Dr Gilbert of Colchester; a work which has hardly been excelled by any, and which, when we consider its date, about the year 1580, is really a wonderful performance.

The most perfect model of this method is the Optics of Sir Isaac Newton. Dr Black's Essay on Magnesia is another very perfect example. Dr Franklin's Theory of Electricity is another example of great merit. That the investigation is not complete, nor the conclusions certain, is not an objection. The method is without fault; and a proper direction is given to the mind for the experiments which are still necessary for establishing the general laws.

101 A good treatise on the method of inquiry by experiment very necessary.

It were much to be wished that some person of talents and of extensive knowledge would give a treatise on the method of inquiry by experiment. Although many beautiful and successful examples have been given as particular branches of inquiry, we have but too many instances of very inaccurate and inconclusive investigations. Experiments made at random, almost without a view, serve but little to advance our knowledge. They are like shapeless lumps of stone merely detached from the rock, but still wanting the skill of the builder to select them for the different purposes which they may chance to serve; while well contrived experiments are blocks cut out by a skilful workman, according as the quarry could furnish them, and of forms suited to certain determined uses in the future edifice. Every little series of experiments by Margraaf terminates in a general law, while hardly any general conclusion can be drawn from the numberless experiments of Pott. Lord Bacon has written much on this subject, and with great judgment and acuteness of distinction; but he has exceeded in this, and has fatigued his readers by his numerous rules; and there is in all his philosophical works, and particularly in this, a quaintness and affectation that greatly obscure his meaning, so that this most valuable part of his writings is very little read.

102 An objection to experimental inquiry.

A formidable objection has been made to this method of inquiry. Since a physical law is only the expression of a general fact, and is established only in consequence of our having observed a similarity in a great number of particular facts; and since the great rule of inductive logic is to give the law no greater extent than the induction on which it is founded—how comes it that a few experiments must be received as the foundation of a general inference? This has been answered in very general terms in the article PHILOSOPHY. But it will be of use to consider the subject a little more particularly. Our observations on this subject are taken from the dissertation on evidence by Dr Campbell in his Philosophy of Rhetoric.

103 The objection answered, with examples showing the nature and certainty of this mode of inquiry.

An attentive consideration of the objects around us, will inform us that they are generally of a complicated nature, not only as consisting of a complication of those qualities of things called accidents, such as gravity, mobility, colour, figure, solidity, which are common to all bodies: but also as consisting of a mixture of a variety of substances, very different in their nature and properties; and each of these is perhaps compounded of ingredients more simple.

Moreover, the farther we advance in the knowledge of nature, we find the more reason to be convinced of her constancy in all her operations. Like causes have always produced like effects, and like effects have always been preceded by like causes. Inconstancy sometimes appears in Nature's works at *first sight*; but a more refined experience shows us that this is but an appearance, and that there is no inconstancy: and we explain it to our satisfaction in this way.

Most of the objects being of a complicated nature, we find, on an accurate scrutiny, that the effects ascribed to them ought often to be solely ascribed to one or more of these component parts, while the others either do not contribute to them, or hinder their production; and the variety of nature is so great, that hardly any two individuals of the same species are in every respect like any other. On all these accounts we expect dissimilitudes in the phenomena accompanying perfectly similar treatment of different subjects of the same kind; but we find, that whenever we can be assured that the two substances are perfectly alike, the phenomena arising from similar treatment are the same: and long and extensive observation teaches us, that there are certain circumstances which insure us in the perfect similarity of constitution of some things. Whenever we observe the effect of any natural agent on one, and but one, of these, we invariably expect that the same will be produced on any other.

Should a botanist meet with a plant new to him, and observe that it has seven monopetalous flowers, he will conclude with the utmost confidence that every plant of this species will have monopetalous flowers; but he will not suppose that it will have seven, and no more than seven, flowers. Now these two facts seem to have no difference to warrant such a difference in the conclusion; which may therefore seem capricious, since there is but one example of both.

But it is not from this example only that he draws the conclusion. Had he never before taken notice of any plant, he would not have reasoned at all from these remarks. But his mind runs immediately from this unknown species to all the known species of this genus, and to all the genera of the same order; and having experienced in the *figure* of the flower an uniformity in every species, genus, and order, which admits of no exception, but, in the *number* of flowers, a variety as boundless as are the circumstances of soil, climate, age, and culture, he learns to mark the difference, and draws the above-mentioned conclusions. Thus we learn, that *perfect* uniformity is not to be expected in any instance whatever, because in no instance is the simplicity of constitution sufficiently great to give us assurance of perfect uniformity in the circumstances of the case; and the utmost

most that our experience can teach us is a quick discrimination of those circumstances which produce the occasional varieties.

The nearer that our investigations carry us to the knowledge of *elementary* natures, the more are we convinced by general experience of the uniformity of the operations of real elements; and although it may perhaps be impossible for us ever to arrive at the knowledge of the simplest elements of any body, yet when any thing *appears* simple, or rather so exactly uniform, as that we have invariably observed it to produce similar effects, on discovering any *new* effect of this substance, we conclude, from a general experience of the efficient, a like constancy in the energy as to the rest. Fire consumes wood, melts lead, and hardens clay. In these instances it acts uniformly, but not in these only. We have always found, that whatever of any species is consumed by it in one instance, has been consumed by it on trial at any time. If therefore a trial be made for the first time of its influence on any particular substance, he who makes it is warranted to conclude that the effect, whatever it may be, is a faithful representative of its effects on this substance in all past and future ages. This conclusion is not founded on this single instance, but upon this instance combined with the general experience of the regularity of this element in its operations.

This general conclusion, therefore, drawn from one experiment, is by no means in opposition to the great rule of inductive logic, but, on the contrary, it is the most general and refined application of it. General laws are here the real subject of consideration; and a law still more general, viz. *that nature is constant in all its operations*, is the inference which is here applied as a principle of explanation of a phenomenon which is itself a general law, viz. *that nature is constant in this operation.*

The foundation of this general inference from one experiment being so firmly established, it is evident that experiments must be an infallible method of attaining to the knowledge of nature; and we need only be solicitous that we proceed in a way agreeable to the great rule of inductive logic; that is, the subject must be cleared of every accidental and *unknown* circumstance, and put into a situation that will reduce the interesting circumstance to a state of the greatest possible simplicity. Thus we may be certain that the event will be a faithful representative of every similar case: and unless this be done in the preparation, nothing can result from the most numerous experiments but uncertainty and mistakes.

104
Mathematics do not supersede the use of experiment.

The account which has been given of mechanical philosophy would seem to indicate that experiment was not of much use in the farther prosecution of it. The two laws of motion, with the assistance of mathematics, seem fully adequate to the explanation of every phenomenon; and so they are to a *certain degree.* But this degree is as yet very limited. Our mathematical knowledge, great as it is in comparison with that of former times, is still insufficient for giving accurate solutions even of very simple (comparatively speaking) questions. We can tell, with the utmost precision, what will be the motions of two particles of matter, or two bodies, which act on each other with forces proportioned to the squares of the distances inversely; but if we add a third particle, or a third body, acting by the same law, the united science of all Europe can only give an approximation to the solution.

105
Experiment is often the only resource.

What is to be done then in the cases which come continually before us, where millions of particles are acting at once on each other in every variety of situation and distance? How shall we determine, for instance, the motion of water through a pipe or sluice when urged by a piston or by its own weight? what will be its velocity and direction? It is impossible, in the present state of mathematical knowledge, to tell with any precision or certainty. And here we must have recourse to experiment. But if this be the case, must the experiment be made in every possible variety of situation, depth, figure, pressure? or is it possible to find out any general rules, founded on the general laws of motion, and rationally deduced from them? Or, if this cannot be accomplished, will experiment itself furnish any general coincidences which show such mutual dependences, that we may consider them as indications of general principles, though subordinate, complicated, and perhaps inscrutable? This can be discovered by experiment alone.

106
Accurate experiments cannot always be made.

The attention of philosophers has been directed to each of these three chances, and considerable progress has been made in them all. Numerous experiments have been made, almost sufficient to direct the practice in many important cases, without the help of any rule or principle whatever. But there are many cases, and these of by far the greatest importance, such as the motion of a ship impelled by the winds, resisted by the water, and tossed by the waves, where distinct experiments cannot be made.

107
Example of the necessity of experiment.

Newton, Bernouilli, d'Alembert, and others, have laboured hard to deduce from the laws of motion rules for determining what may be called the *average* motion of water in these circumstances, without attempting to define the path or motion of any individual particle; and they have actually deduced many rules which have a great degree of probability. It may here be asked, why do you say *probability?* the rules, as far as they go, should be *certain.* So they are: they are strict deductions from their premisses. But the premisses are only *suppositions*, of various degrees of probability, assumed in order to simplify the circumstances of the case, and to give room for mathematical reasoning; therefore these deductions, these rules, must be examined by experiment. Some of the suppositions are such as can hardly be refused, and the rules deduced from them are found to tally precisely with the phenomena. Such is this, "that the velocities of issuing water in similar circumstances are in the sub-duplicate ratio of the pressures." And this rule gives a most important and extensive information to the engineer. Other suppositions are more gratuitous, and the rules deduced from them are less coincident with the phenomena. The patient and sagacious Newton has repeatedly failed in his attempts to determine what is the *absolute velocity* of water issuing from a hole in the bottom of the vessel when urged by its weight alone, and the attempts of the others have hardly succeeded better. Experiment is therefore absolutely necessary on this head.

Those who have aimed at the discovery of *rules* purely experimental on this subject, have also been pretty successful; and the Chevalier Buat has, from a comparison.

son of an immense variety of experiments made by himself and various authors deduced an empirical rule, which will not be found to deviate from truth above one part in ten in any case which has yet come to our knowledge.

This instance may serve to show the use of experiments in mechanical philosophy. It is proper in all cases by way of illustration; and it is absolutely necessary in most, either as the foundation of a characteristic of a particular class of phenomena, or as argument in support of a particular doctrine. Hydrostatics, hydraulics, pneumatics, magnetism, electricity, and optics, can hardly be studied in any other way; and they are at present in an imperfect state, and receiving continual improvement by the labours of experimental philosophers in all quarters of the world.

108 The advantages derived from the study of philosophy

Having in the preceding paragraphs given a pretty full enumeration of the different subjects which are to be considered in the study of natural philosophy, it will not be necessary to spend much time in a detail of the advantages which may reasonably be expected from a successful prosecution of this study. It stands in no need of panegyric: its intimate connection with the arts gives it a sufficient recommendation to the attention of every person. It is the foundation of many arts, and it gives liberal assistance to all. Indebted to them for its origin and birth, it has ever retained its filial attachment, and repaid all their favours with the most partial affection.

109 in navigation,

To this science the navigator must have recourse for that astronomical knowledge which enables him to find his place in the trackless ocean; and although very small scraps of this knowledge are sufficient for the mere pilot, it is necessary that the study be prosecuted to the utmost by some persons, that the unlearned pilot may get that scanty pittance which must direct his routine. The few pages of tables of the sun's declination, which he uses every day to find his latitude, required the successive and united labours of all the astronomers of Europe to make them tolerably exact: and in order to ascertain his longitude with precision, it required all the genius of a Newton to detect the lunar irregularities, and bring them within the power of the calculator; and, till this was done, the respective position of the different parts of the earth could not be ascertained. Vain would have been the attempt to do this by geodætical surveys independent of astronomical observation. It is only from the most refined mechanics that we can hope for sure principles to direct us in the construction and management of a ship, the boast of human art, and the great means of union and communication between the different quarters of the globe.

110 in architecture,

A knowledge of mechanics not much inferior to this is necessary for enabling the architect to execute some of his greatest works, such as the erection of domes and arches, which depend on the nicest adjustment of equilibrium. Without this he cannot unite economy with strength; and his works must either be clumsy masses or flimsy shells.

111 in gunnery and other engines, &c.

The effects of artillery cannot be understood or secured without the same knowledge.

The whole employment of the engineer, civil or military, is a continual application of almost every branch of mechanical knowledge; and while the promises of a Smeaton, a Watt, a Belidor, may be confided in as if already performed, the numberless failures and disappointments in the most important and costly projects show us daily the ignorance of the pretending crowd of engineers.

The microscope, the steam engine, the thunder-rod, are presents which the world has received from the natural philosopher; and although the compass and telescope were the productions of chance, they would have been of little service had they not been studied and improved by Gilbert, Halley, and Dollond.

But it is not in the arts alone that the influence of natural philosophy is perceived: it lends its aid to every science, and in every study.

112 in law,

It is often necessary to have recourse to the philosopher in disputes concerning property; and many examples might be given where great injustice has been the consequence of the ignorance of the judges. Knowledge of nature might have prevented many disgraceful condemnations for sorcery.

113 in history,

The historian who is ignorant of natural philosophy easily admits the miraculous into his narrations, accompanies these with his reflections, draws consequences from them, and fills his pages with prodigies, fables, and absurdity.

114 in medicine,

It is almost needless to speak of the advantages which will accrue to the physician from this study. So close is the connection between it and medicine, that our language has given but one name to the naturalist and to the medical philosopher. Indeed, the whole of his study is a close observation of the laws of material nature, in order to draw from them precepts to direct his practice in the noble art of healing. During the immaturity of general knowledge, while natural philosophy was the only study which had acquired any just pretension to certitude either in its principles or method of investigation, the physicians endeavoured to bring the objects of their study within its province, hoping by this means to get a more distinct view of it; and they endeavoured to explain the abstruse phenomena of the animal functions by reducing them all to motions, vibrations, collisions, impulses, hydrostatic and hydraulic pressures and actions, with which the mechanical philosophers were so ardently occupied at that time. But unfortunately their acquaintance with nature was then very limited; and they were but little habituated to the rules of just reasoning; and their attempts to explain the economy of animal life by the laws of mechanics did them but little service either for the knowledge of diseases or of the methods of cure. The mechanical theories of medicine, which had considerable reputation about the end of the 17th century, were many of them very ingenious, and had an imposing appearance of symmetry and connection; but are now forgotten, having all been formed on the narrow supposition that matter was subject only to mechanical laws.

But the discovery of error diminishes the chance of again going wrong, especially when the cause of error has been discovered, and the means pointed out of detecting the mistakes; and the vital principle must combine its influence with, or operate on, the properties of rude matter. It appears therefore evident that a knowledge of the mechanical laws of the material world is not only a convenient, but a necessary, accomplishment to the physician. We are fully justified in this opinion, by observing medical authors of the present day introducing into medicine theories borrowed from mechanical philosophy, which they do not understand, and which they continually misapply. Appearance of reasoning frequently conceals the errors in principle, and seldom fails to mislead.

115 in religion,

But there is no class of men to whom this science is of more service than to those who hold the honourable office of the teachers of religion. Their knowledge in their own science, and their public utility, are prodigiously hurt by ignorance of the general frame and constitution of nature; and it is much to be lamented that this science is so generally neglected by them, or considered only as an elegant accomplishment: nay, it is too frequently shunned as a dangerous attainment, as likely to unhinge their own faith, and taint the minds of their hearers. We hope, however, that few are either so feebly rooted in the belief of the great doctrines of religion as to fear this, or of minds so base and corrupted as to adopt and inculcate a belief which they have any suspicion of being ill-founded. But many have a sort of horror at all attempts to account for the events of nature by the intervention of general causes, and think this procedure derogatory to the Divine nature, and inconsistent with the doctrine of his particular providence; believing, that "a sparrow does not fall to the ground without the knowledge of our heavenly Father." Their limited conceptions cannot perceive, that, in forming the general law, the Great Artist did at one glance see it in its remotest and most minute consequence, and adjust the vast assemblage so as completely to answer every purpose of His providence. There never was a more eager enquirer into the laws of nature, or more ardent admirer of its glorious Author, than the Hon. Robert Boyle. This gentleman says, that he will always think more highly of the skill and power of that artist who should construct a machine, which, being once set a going, would of itself continue its motion for ages, and from its inherent principles continue to answer all the purposes for which it was first contrived, than of him whose machine required the continual aid of the hand which first constructed it. It is owing to great inattention that this aversion to the operation of secondary causes has any influence on our mind. What do we mean by the introduction of secondary causes? How do we infer the agency of any cause whatever? Would we ever have supposed any cause of the operations of nature, had they gone on without any order or regularity? Or would such a chaos of events, any more than a chaos of existences, have given us any notion of a forming and directing hand? No surely. We see the hand of God in the regular and unvaried course of nature, only because it is regular and unvaried. The philosopher expresses this by saying, that the phenomena proceed by unalterable laws. Greatly mistaken therefore are they who think that we supersede the existence of mind and of providence when we trace things to their causes. A physical law being an unvaried fact, is an indication, and the strongest possible indication, of an unerring mind, who is incapable of change, and must do to day what He always did: for to change is to deviate from what is best *. The operations of unerring mind will therefore be regular and invariable. Physical laws, therefore, or secondary causes, are the best proofs of unerring wisdom. Such regularity of conduct is universally considered as an indication of wisdom among men. The wise man is known by the constancy of his conduct, while no man can depend on the future conduct of a fool.

And what astonishing evidences of wisdom do we not observe in the general laws of the material world? They will ever be considered by the intelligent philosopher as the most glorious display of inconceivable wisdom, which has been able, by means so few and so simple, to produce effects which by their grandeur astonish our feeble understandings, and by their inexhaustible variety elude all possibility of enumeration.

While the teachers of religion remain ignorant of the beautiful laws of nature, the great characteristics of the wisdom and goodness of the Almighty Creator, their hearers are deprived of much sublime pleasure; God is robbed of that praise which he would have received from an enlightened people; and the only worship he receives is tainted with mean notions of his attributes, and groundless fears of his power.

But besides these advantages which accrue to different classes of men from this study, there are some effects which are general, and are too important to be passed over unnoticed.

116 and in other sciences.

That spirit of dispassionate experimental enquiry which has so greatly promoted this study, will carry with it, into every subject of enquiry, that precision and that constant appeal to fact and experience which characterize it. And we may venture to assert, that the superior good order and method which distinguish some of the later productions in other sciences, have been in a great measure owing to this mathematical spirit, the success of which in natural philosophy has gained it credit, and thus given it an unperceived influence even over those who have not made it their study.

117 More general advantages of philosophy.

The truths also which the naturalist discovers are such as do not in general affect the passions of men, and have therefore a good chance of meeting with a candid reception. Those whose interest it is to keep men in political or religious ignorance, cannot easily suspect bad consequences from improvements in this science; and if they did, have hardly any pretext for checking its progress. And discoveries accustom the mind to novelty; and it will no longer be startled by any consequences, however contrary to common opinion. Thus the way is paved for a rational and discreet scepticism, and a free enquiry on other subjects. Experiment, not authority, will be considered as the test of truth; and under the guidance of fair experience we need fear no ill as long as the laws of nature remain as they are.

Lastly, since it is the business of philosophy to describe the phenomena of nature, to discover their causes, to trace the connection and subordination of these causes, and thus obtain a view of the whole constitution of nature; it is plain that it affords the surest path for arriving at the knowledge of the great cause of all, of God himself, and for forming proper conceptions of him and of our relations to him: notions infinitely more just than can ever be entertained by the careless spectator of his works. Things which to this man appear solitary and detached, having no other connection

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* *Ferguson's Lectures on Ethics.*

tion with the rest of the universe but the shadowy and fleeting relation of co-existence, will, to the diligent philosopher, declare themselves to be parts of a great and harmonious whole, connected by the general laws of nature, and tending to one grand and beneficent purpose. Such a contemplation is in the highest degree pleasant and cheering, and cannot fail of impressing us with the wish to co-operate in this glorious plan, by acting worthy of the place we hold among the works of God, and with the hopes of one day enjoying all the satisfaction that can arise from conscious worth and consummate knowledge; and this is the worship which God will approve. "This universe (says Boyle) is the magnificent temple of its great Author; and man is ordained, by his powers and qualifications, the high priest of nature, to celebrate divine service in this temple of the universe."

PHYSIOGNOMONICS, among physicians, denote such signs as, being taken from the countenance, serve to indicate the state, disposition, &c. both of the body and mind: and hence the art of reducing these signs to practice is termed *physiognomy*.

PHYSIOGNOMY

1 Various definitions of physiognomy ancient and modern.

IS a word formed from the Greek *φυσις*, *nature*, and *γινωσκω*, *I know*. It is the name of a science which occupied much of the attention of ancient philosophers, and which, since the revival of learning, has in a great degree been disregarded. Till of late it has seldom in modern times been mentioned, except in conjunction with the exploded arts of magic, alchemy, and judicial astrology. Within the last two centuries, no doubt, the bounds of human knowledge have been greatly extended by means of the patient pursuit of fact and experiment, instead of the hasty adoption of conjecture and hypothesis. We have certainly discovered many of the ancient systems to be merely creatures of imagination. Perhaps, however, in some instances, we have decided too rapidly, and rejected real knowledge, which we would have found it tedious and troublesome to acquire. Such has been the fate of the science of physiognomy; which certainly merits to be considered in a light very different from alchemy and those other fanciful studies with which it had accidentally been coupled. The work lately published by M. Lavater on the subject has indeed excited attention, and may perhaps tend to replace physiognomy in that rank in the circle of the sciences to which it seems to be intitled.

It does not appear that the ancients extended the compass of physiognomy beyond *man*, or at least animated nature: But the study of that art was revived in the middle ages, when, misled probably by the comprehensiveness of the etymological meaning of the word, or incited by the prevalent taste for the marvellous, those who treated of the subject stretched the range of their speculation far beyond the ancient limits. The extension of the signification of the term was adopted universally by those naturalists who admitted the theory of signatures (see SIGNATURE); and physiognomy came thus to mean, the knowledge of the *internal* properties of *any* corporeal existence from the *external* appearances. Joannes Baptista Porta, for instance, who was a physiognomist and philosopher of considerable eminence, wrote a treatise on the physiognomy of *plants (philognomonica)*, in which he employs physiognomy as the generic term. There is a treatise likewise *De Physiognomia Avium*, written, we believe, by the same person. In the *Magia Physiognomica* of Gaspar Schottus, *physiognomia humana* is made a *subdivision* of the science.

Boyle too adopts the extensive signification mentioned, which indeed seems to have been at one time the usual acceptation of the word (A). At present physiognomy seems to mean no more than "a knowledge of the moral character and extent of intellectual powers of human beings, from their external appearance and manners." In the Berlin Transactions for the years 1769 and 1770 there appears a long controversial discussion on the subject of the *definition* of physiognomy between M. Pernetty and M. Le Cat, two modern authors of some note. Pernetty contends that *all knowledge whatever* is physiognomy; Le Cat confines the subject to the *human face*. Neither seems to have hit the medium of truth. Soon after the celebrated book of Lavater appeared. He indeed defines physiognomy to be "the art of discovering the *interior* of *man* by means of his *exterior*; but in different passages of his work he evidently favours the extended signification of Pernetty. This work gave occasion to M. Formey's attack upon the science itself in the same Berlin Transactions for 1775. Formey strenuously controverts the extent assigned by Lavater to his favourite science.

2 Pythagoras probably brought this science to Greece.

Before the era of Pythagoras the Greeks had little or no science, and of course could not be scientifical physiognomists. Physiognomy, however, was much cultivated in Egypt and India; and from these countries the

sage

(A) They'll find i' the physiognomies
O' th' planets all men's destinies. HUDIBRAS.

sage of Samos probably introduced the rudiments of this science, as he did those of many others, generally deemed more important into Greece.

3
It was a profession in the time of Socrates.

In the time of Socrates it appears even to have been adopted as a profession. Of this the well-known anecdote of the decision of Zopyrus, on the real character of Socrates himself, judging from his countenance, is sufficient evidence. Plato mentions the subject; and by Aristotle it is formally treated of in a book allotted to the purpose.

It may be worth while to give a brief outline of Aristotles sentiments on the subject.

4
General outline of Aristotle's opinion on this subject.

Physiognomy, he in substance observes, had been treated of in three ways. Some philosophers classed animals into genera, and ascribed to each genus a certain mental disposition corresponding to their corporeal appearance. Others made a farther distinction of dividing the genera into species. Among men, for instance, they distinguished the Thracians, the Scythians, the Egyptians, and whatever nations were strikingly different in manners and habits, to whom accordingly they assigned the distinctive physiognomical characteristics. A third set of physiognomists judged of the actions and manners of *the individual*, and presumed that certain manners proceeded from certain dispositions. But the method of treating the subject adopted by Aristotle himself was this: A peculiar form of body is invariably accompanied by a peculiar disposition of mind; a human intellect is never found in the corporeal form of a beast. The mind and body reciprocally affect each other; thus in intoxication and mania the mind exhibits the affections of the body; and in fear, joy, &c. the body displays the affections of the mind.

From such facts he argues, that when in man a particular bodily character appears, which by prior experience and observation has been found uniformly accompanied by a certain mental disposition, with which therefore it must have been necessarily connected; we are intitled in all such cases to infer the disposition from the appearance. Our observations, he conceives, may be drawn from other animals as well as from men: for as a lion possesses one bodily form and mental character, a hare another, the corporeal characteristics of the lion, such as strong hair, deep voice, large extremities, discernible in a human creature, denote the strength and courage of that noble animal; while the slender extremities, soft down, and other features of the hare, visible in a man, betray the mental character of that pusillanimous creature.

Upon this principle Aristotle treats of the corporeal features of man, and the correspondent dispositions, so far as observed: he illustrates them by the analogy just mentioned, and in some instances attempts to account for them by physiological reasoning.

At the early period in which Aristotle wrote, his theory, plausible certainly, and even probable, displays his usual penetration, and a considerable degree of knowledge. He distinctly notices individual physiognomy, national physiognomy, and comparative physiognomy. The state of knowledge in his time did not admit of a complete elucidation of his general principles; on that account his enumeration of particular observations and precepts is by no means so well founded or so accurate as his method of study. Even his style, concise and energetic, was inimical to the subject; which, to be made clearly comprehensible, must require frequent paraphrases. Aristotle's performance, however, such as it is, has been taken as the groundwork and model of every physiognomical treatise that has since appeared.

The imitators of this great man in the 16th and 17th centuries, have even copied his language and manner, which are sententious, indiscriminate, and obscure. His comparative physiognomy of men with beasts has been frequently though not universally adopted. Besides his treatise expressly on the subject, many incidental observations on physiognomy will be found interspersed through his other works, particularly in his history of animals.

5
Theophrastus's ethic characters form an important branch of physiognomy.

Next after Aristotle, his disciple and successor Theophrastus would deserve to be particularly mentioned as a writer on the subject in question. His ethic characters, a singular and entertaining performance, composed at the age of 99, form a distinct treatise on a most important branch of physiognomy, *the physiognomy of manners;* but the translations and imitations of La Bruyere are so excellent, that by referring to them we do greater justice than would otherwise be in our power, both to Theophrastus and to our readers. We cannot, however, omit observing, that the accuracy of observation and liveliness of description displayed in the work of Theophrastus will preserve it high in classical rank, while the science of man and the prominent characteristics of human society continue to be objects of attention.

6
Other Greek authors on this subject.

Polemon of Athens, Adamantius the sophist, and several others, wrote on the subject about the same period. Lately there was published a collection of all the Greek authors on physiognomy: the book is entitled, *Physiognomiæ veteris scriptores Græci, Gr. et Lat. à Franzio Altenb.* 1780, 8vo. From the number of these authors, it appears that the science was much cultivated in Greece; but the professors seem soon to have connected with it something of the marvellous. This we have cause to suspect from the story told by Apion of Apelles: *Imaginem adeo similitudinis indiscretæ pinxit, ut (incredibile dictu) Apion Grammaticus Scriptum reliquerit quemdam ex facie hominum ad divinantem (quos melaposcopos vocant) ex iis dixisse aut futuræ mortis annos, aut præteritæ* *. The noviciates of the Pythagorean school were subjected to the physiognomic observation of their teachers, and it is probable the first physiognomists by profession among the Greeks were of this sect. They, too, to whom, from the nature of their doctrines and discipline, mystery was familiar, were the first, it is likely, who exposed the science of physiognomy in Greece to disgrace, by blending with it the art of divination.

7
The science was then coupled with something of the marvellous.

8
The observations of Roman and other writers.

From the period of which we have been treating to the close of the Roman republic, nothing worthy of remark occurs in the literary history of physiognomy. About the last-mentioned era, however, and from thence to the decline of the empire under the later emperors, the science appears to have been cultivated as an important branch of erudition, and assumed as a profession by persons who had acquired a superior knowledge in it.

In the works of Hippocrates and Galen, many physiognomical observations occur. Cicero appears to have been peculiarly attached to the science. In his oration

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* *Pliny Nat. Hist.* lib. 35. § 35. par. 39.

tion against Piso, and in that in favour of Roscius, the reader will at the same time perceive in what manner the orator employs physiognomy to his purposes, and find a curious instance of the *ancient* manner of oratorical *abuse*.

Many physiognomical remarks are to be found likewise in the writings of Sallust, Suetonius, Seneca, Pliny, Aulus Gellius, Petronius, Plutarch, and others.

That in the Roman empire the science was practised as a profession, ample evidence appears in the writings of several of the authors just mentioned. Suetonius, for instance, in his *Life of Titus*, mentions that Narcissus employed a *physiognomist* to examine the features of Britannicus, who predicted that Britannicus would not succeed, but that the empire would devolve on Titus.

9 This science fell with the Roman empire.

The science of physiognomy shared the same fate with all others, when the Roman empire was overthrown by the northern barbarians. About the beginning of the 16th century it began again to be noticed.—From that time till the close of the 17th, it was one of the most fashionable studies. Within that space have appeared almost all the approved modern authors on the subject (B).

It has been unfortunate for physiognomy, that by many of these writers it was held to be connected with doctrines of which the philosophy of the present day would be ashamed. With these doctrines it had almost sunk into oblivion.

10 Particular studies have peculiarly prevailed at particular times.

In every period of the history of literature there may easily be marked a prevalence of particular studies. In the early period, for instance, of Grecian literature, *mythological morality* claimed the chief attention of the philosophers. In the more advanced state of learning in Greece and in Rome, *poetry*, *history*, and *oratory*, held the pre-eminence. Under the latter emperors, and for some time afterwards, the history of *theological controversies* occupied the greatest part of works of the learned. Next succeeded *metaphysics*, and *metaphysical theology*. These gave place to *alchemy*, *magic*, *judicial astrology*, the doctrine of signatures and sympathies, the *mystic*, *theosophic*, *and Rosicrucian theology*, with physiognomy. Such were the pursuits contemporary with the science which is the object of our present inquiry. It is no matter of surprise, that, so associated, it should have fallen into contempt. It is not unusual for mankind hastily to reject valuable opinions, when accidentally or artificially connected with others which are absurd and untenable. Of the truth of this remark, the history of theology, and the present tone of theological opinions in Europe, furnish a pregnant example.

To physiognomy, and the exploded sciences last mentioned, succeeded *classic philology*; which gave place to *modern poetry* and *natural philosophy*; to which recently have been added the studies of *rational theology*, *chemistry*, the *philosophy of history*, the *history of man*, and the *science of politics*.

11 The observations of the writers of the present century on this subject.

About the commencement of the 18th century, and thenceforward, the occult sciences, as they are termed, had declined very considerably in the estimation of the learned; and those who treated of physiognomy forbore to disgrace it by a connection with those branches of ideal learning with which formerly it had been invariably conjoined. In Britain, Dr Gwither noticed it with approbation.—His remarks are published in the Philosophical Transactions, vol. xviii.; and Dr Parsons chose it for the subject of the Croonean lectures, published at first in the second supplement to the 44th volume of the Philosophical Transactions, and afterwards (1747) in a separate treatise, entitled *Human Physiognomy explained*.

The observations, however, of these writers, as well as of Lancisius, Haller, and Buffon, relate rather to the transient expression of the passions than to the permanent features of the face and body. The well-known characters of Le Brun likewise are illustrative of the transient physiognomy, or (as it is termed) pathognomy.—See PASSIONS *in Painting*.

12 We find nothing very important till the controversy between Pernetty and Le Cat.

During the present century, although physiognomy has been now and then attended to, nothing of importance appeared on the subject till the discussion already mentioned between Pernetty and Le Cat, in the Berlin Transactions. The sentiments of these authors, in so far as relates to the *definition* of physiognomy, have been above noticed. Their essays are, besides, employed in discussing the following questions: 1st, Whether it would or would not be advantageous to society, were the character, disposition, and abilities, of each individual so marked in his appearance as to be discovered with certainty?

2dly, Whether, on the supposition that by the highest possible proficiency in physiognomy, we could attain a knowledge in part only of the internal character, it would be advantageous to society to cultivate the study, mankind being in general imperfect physiognomists?

No reasoning *à priori* can possibly determine these questions. Time and experience alone must ascertain the degree of influence which any particular acquisition of knowledge would have on the manners and characters of mankind; but it is difficult to conceive how the *result* of any portion of knowledge, formerly unknown, and which mankind would be *permitted* to discover, could be any thing but beneficial.

13 Lavater's celebrated Work.

Soon after this controversy in the Berlin Transactions, appeared the great work of M. Lavater, dean of Zurich, which has excited no inconsiderable portion of attention in the literary world. The work itself is magnificent: That circumstance, as well as the nature of the subject, which was supposed to be fanciful, have contributed to extend

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(B) They are, Bartholem. Cocles, Baptista Porta, Honoratus Nuquetius, Jacobus de Indagine, Alstedius, Michael Schottus, Gaspar Schottus, Cardan, Taisnierus, Fludd, Behmen, Barelay, Claromontius, Conringius, the commentaries of Augustin Niphus, and Camillus Balbus, on the Physiognomica of Aristotle,—Spontanus, Andreas Henricus, Joannes Digander, Rud. Goclenius, Alex. Achillinus, Joh. Prætorius, Jo. Belot, Guliel. Gratalorus, &c. They are noticed in the Polyhistor of Morhoff, vol. i. lib. i. cap. 15. § 4. and vol. ii. lib. iii. cap. i. § 4.

extend its fame; and certainly, if we may judge, the book, though many faults may be detected in it, is the most important of any that has appeared on the subject since the days of Aristotle. Lavater professes not to give a complete synthetical treatise on physiognomy, but, aware that the science is yet in its infancy, he exhibits fragments only, illustrative of its different parts. His performance is no doubt desultory and unconnected. It contains, however, many particulars much superior to any thing that had ever before appeared on the subject.

With the scholastic and systematic method adopted by the physiognomists of the last and preceding centuries, Lavater has rejected their manner of writing, which was dry, concise, indeterminate, and general: His remarks, on the contrary, are, for the most part, precise and particular, frequently founded on distinctions extremely acute. He has omitted entirely (as was to be expected from a writer of the present day) the astrological reveries, and such like, which deform the writings of former physiognomists; and he has with much propriety deduced his physiognomical observations but seldom from anatomical or physiological reasoning. Such reasoning may perhaps at some future period become important; but at present our knowledge of facts, although extensive, is not so universal, as to become the stable foundation of particular deductions. Lavater has illustrated his remarks by engravings; a method first adopted by Baptista Porta.—Lavater's engravings are very numerous, often expressive, and tolerably executed.

14 His opinions the result of observation.

The opinions of this celebrated physiognomist are evidently the result of actual observation. He appears indeed to have made the science his peculiar study, and the grand pursuit of his life. His performance exhibits an extended comprehension of the subject, by a particular attention to *osseal* physiognomy, and the effect of *profiles* and *contours*. His style in general is forcible and lively, although somewhat declamatory and digressive. His expressions are frequently precise, and strikingly characteristic; and the spirit of piety and benevolence which pervades the whole performance renders it highly interesting.

15 His imagination has, however, often outstript his judgement.

The defects of the work, however, detract much from the weight which Lavater's opinions might otherwise challenge. His imagination has frequently so far outstript his judgment, that an ordinary reader would often be apt to reject the whole system as the extravagant reverie of an ingenious theorist. He has clothed his favourite science in that affected mysterious air of importance, which was so usual with his predecessors, and describes the whole material world to be objects of the universal dominion of physiognomy *. He whimsically conceives it necessary for a physiognomist to be a well-shaped handsome man †. He employs a language which is often much too peremptory and decisive, disproportioned to the real substance of his remarks, or to the occasion of making them. The remarks themselves are frequently opposite in appearance to common observation, and yet unsupported by any illustrations of his.

16 Other weaknesses of this great physiognomist.

Lavater certainly errs in placing too great a reliance on single features, as the foundation of decision on character. His opinions on the physiognomy of the ears, hands, nails, and feet of the human species, on hand-writing, on the physiognomy of birds, insects, reptiles, and fishes, are obviously premature, as hitherto no sufficient number of accurate observations has been made, in regard to either of these particulars, to authorise any conclusion. He has erred in the opposite extreme, when treating of the important topic of national physiognomy, where he has by no means prosecuted the subject so far as facts might have warranted. We must farther take the liberty to object to the frequent introduction of the author's own physiognomy throughout the course of his work. His singular remarks on his own face do not serve to prejudice the reader in favour of his judgment, however much his character may justify the truth of them. We must regret likewise, for the credit of the science, that the author's singularly fanciful theory of apparitions should so nearly resemble a revival of the antiquated opinions of the sympathists.

To these blemishes, which we have reluctantly enumerated, perhaps may be added that high impassioned tone of enthusiasm in favour of his science everywhere displayed throughout the work of this author, which is certainly very opposite to the cool patient investigation befitting philosophy. To that enthusiasm, however, it is probable that in this instance (as is, indeed, no unfrequent effect of enthusiasm) we are indebted for the excellency which the author has attained in his pursuit; and it possesses the salutary tendency of putting us on our guard against a too implicit acquiescense in his physiognomical decisions.

17 His work was attacked in the Berlin Transactions by M. Formey.

In the Berlin Transactions for 1775, there appears a formal attack upon Lavater's work by M. Formey. This essay we have already mentioned. After disputing the propriety of the extensive signification applied by Lavater and Pernetty to the term physiognomy, M. Formey adopts nearly the same definition which we conceive to be the most proper, and which we have put down as such near the beginning of this article. He allows that the mental character is intimately connected with, and sensibly influenced by, every fibre of the body; but his principal argument against physiognomy is, that the human frame is liable to innumerable accidents, by which it may be changed in its external appearance, without any correspondent change of the disposition; so that it surpasses the extent of the skill of mortals to distinguish the modifications of feature that are natural, from those which may be accidental. Although, therefore, the science of physiognomy may be founded in truth, he infers that the Deity only can exercise it.

M. Formey further contends, that education, diet, climate, and sudden emotions, nay even the temperaments of ancestors, affect the cast of human features; so that the influence of mental character on these features may be so involved with, or hidden by, accidental circumstances, that the study of physiognomy must ever be attended by hopeless uncertainty. These objections are worthy of notice, but they are by no means conclusive.

18 Lavater's mode of treating his subject.

We shall give a specimen of M. Lavater's manner of treating the subject on the opposite side of the question: A specimen, not in Lavater's precise words, but conveying more shortly an idea at once of his sentiments, and of his manner of expressing them.

19 Physiognomy is justly called a science.

No study, says he, excepting mathematics, more justly deserves to be termed *a science* than physiognomy. It is a department of physics, including theology and belles lettres, and in the same manner with these sciences

may

* Vol. i. p. 33—38. vol. ii. p 89. French translation.

† Vol i p. 126.

may be reduced to rule. It may acquire a fixed and appropriate character: It may be communicated and taught.

Truth or knowledge, explained by fixed principles, becomes science. Words, lines, rules, definitions, are the medium of communication. The question, then, with respect to physiognomy, will thus be fairly stated. Can the striking and marked differences which are visible between one human face, one human form, and another, be explained, not by obscure and confused conceptions, but by certain characters, signs, and expressions? Are these signs capable of communicating the vigour or imbecility, the sickness or health, of the body; the wisdom, the folly, the magnanimity, the meanness, the virtue, or the vice, of the mind?

20
Experiment is limited in extent.

It is only to a certain extent that even the experimental philosopher can pursue his researches. The active and vigorous mind, employed in such studies, will often form conceptions which he shall be incapable of expressing in words, so as to communicate his ideas to the feebler mind, which was itself unable to make the discovery: But the lofty, the exalted mind, which soars beyond all written rule, which possesses feelings and energies reducible to no law, must be pronounced unscientific.

21
Physiognomical truth may be defined and communicated to a certain length.

It will be admitted, then, that to a certain degree physiognomical truth may as a science be defined and communicated. Of the truth of the science, there cannot exist a doubt. Every countenance, every form, every created existence, is individually distinct, as well as different, in respect of class, race, and kind. No one being in nature is precisely similar to another. This proposition, in so far as regards man, is the foundation-stone of physiognomy. There may exist an intimate analogy, a striking similarity, between two men, who yet being brought together, and accurately compared, will appear to be remarkably different. No two minds perfectly resemble each other. Now, is it possible to doubt that there must be a certain native analogy between the external varieties of countenance and form and the internal varieties of the mind? By anger the muscles are rendered protuberant: Are not, then, the angry mind, and the protuberant muscles, as cause and effect? The man of acute wit has frequently a quick and lively eye. Is it possible to resist the conclusion, that between such a mind and such a countenance there is a determinate relation?

Every thing in nature is estimated by its physiognomy; that is, its external appearance. The trader judges by the colour, the fineness, the exterior, the *physiognomy* of every article of traffic; and he at once decides that the buyer "has an honest look," or "a pleasing or forbidding countenance.

22
This knowledge, however improved would not be detrimental to man.

That knowledge and science are detrimental to man, that a state of rudeness and ignorance are preferable and productive of more happiness, are tenets now deservedly exploded. They do not merit serious opposition. The extension and increase of knowledge, then, is an object of importance to man: And what object can be so important as the knowledge of man himself? If knowledge can influence his happiness, the knowledge of himself must influence it the most. This useful knowledge is the peculiar province of the science of physiognomy. To conceive a just idea of the advantages of physiognomy, let us for a moment suppose that all physiognomical knowledge were totally forgotten among men; what confusion, what uncertainty, what numberless mistakes, would be the consequence? Men destined to live in society must hold mutual intercourse. The knowledge of man imparts to this intercourse its spirit, its pleasures, its advantages.

23
It affords great mental gratification.

Physiognomy is a source of pure and exalted mental gratification. It affords a new view of the perfection of Deity; it displays a new scene of harmony and beauty in his works; it reveals internal motives, which without it would only have been discovered in the world to come. The physiognomist distinguishes accurately the permanent from the habitual, the habitual from the accidental, in character. Difficulties, no doubt, attend the study of this science. The most minute shades, scarcely discernible to the unexperienced eye, denote often total opposition of character. A small inflexion, diminution, lengthening or sharpening, even though but of a hair's-breadth, may alter in an astonishing degree the expression of countenance and character. How difficult then, how impossible indeed, must this variety of the same countenance render precision? The seat of character is often so hidden, so masked, that it can only be detected in certain, perhaps uncommon, positions of countenance. These positions may be so quickly changed, the signs may so instantaneously disappear, and their impression on the mind of the observer may be so slight, or these distinguishing traits themselves so difficult to seize, that it shall be impossible to paint them or describe them in language. Innumerable great and small accidents, whether physical or moral, various incidents and passions, the diversity of dress, of position, of light or shade, tend to display the countenance often in so disadvantageous a point of view, that the physiognomist is betrayed into an erroneous judgment of the true qualities of the countenance and character. Such causes often occasion him to overlook the essential traits of character, and to form a decision on what is purely accidental.—How surprisingly, for instance, may the smallpox disfigure the countenance, and destroy or confound, or render imperceptible, traits otherwise the most decisive?

24
Difficulties in the study.

25
May one day be obviated.

We shall, then, continues Lavater, grant to the opposer of phiosognomy all he can ask; and yet we do not live without hopes that many of the difficulties shall be resolved which at first appeared inexplicable.

26
The nature of Lavater's work.

He then proceeds to a specific illustration of his subject under a great variety of titles, in which he treats of human nature in general, and of each particular feature separately.

To enumerate the different divisions of his book would not be more satisfactory to our readers than the perusal of the *contents* of the book itself; and an attempt to epitomize even the essential substance of the vast multiplicity of matter contained in his essays, (which are yet only *fragments*, and to which indeed he himself does not pretend to give any higher appellation), would extend this article to a disproportionate length. Such an abridgement, after all, would convey no solid information on a subject which merits all the time and study that an attentive perusal of Lavater's works at large would require.

27
Probable causes of the disrepute into which this science has fallen.

From the historical deduction of the literary progress of physiognomy which we have thus attempted to lay before our readers, it appears, that although the science has fallen into disrepute, there can scarcely be mentioned a period in which any cultivation of science took place when physiognomy was not likewise the study, nay sometimes even the profession, of men of the most eminent abilities and the greatest learning.

The reasons why at present so little attention is paid to the subject probably are,

1st, That it has been treated in conjunction with subjects now with propriety exploded: And,

2dly, That it has been injured by the injudicious assertions and arguments of those who have undertaken its defence.

Sometimes, however, the wise and the learned may err. The use of any thing must not be rejected for no better reason than that it is capable of abuse. Perhaps the era is not distant when physiognomy shall be reinstated in the rank which she merits among the valuable branches of human knowledge, and be studied with that degree of attention and perseverance which a subject deserves so essentially connected with the science of man.

28 There is a relation between the dispositions of the mind and the features of the face.

That there is an intimate relation between the dispositions of the mind and the features of the countenance is a fact which cannot be questioned. He who is sinking under a load of grief for the death of an affectionate wife or a dutiful child, has a very different cast of features from the man who is happy in the prospect of meeting his mistress. A person boiling with anger has a threatening air in his countenance, which the most heedless observer never mistakes; and if any particular disposition be indulged till it become habitual, there cannot be a doubt but that the corresponding traces will be so fixed in the face as to be discernible by the skilful physiognomist, under every effort made to disguise them. But when we attempt to decide on a man's intellectual powers by the rules of this science, we are often deceived; and in this respect we have reason to believe that Lavater himself has fallen into the grossest mistakes.

29 Craniognomic system of Dr Gall.

Connected with physiognomy, we may consider the *craniognomic* system of Dr Gall of Vienna, which is so called, because, from the exterior form of the cranium, he infers the powers and dispositions of the mind. The brain, he observes, is the material organ of the action of the mind; and as it increases in direct proportion to the faculties of animals, he has endeavoured to prove, that the faculties are distinct and independent on each other; that each has its proper material organ, and that the expansion of the organ is in proportion to the strength of the faculty. This system is attempted to be established by the following reasoning.

"The internal faculties, (says Dr Bojanus, the author of a view of this system), do not always exist in the same proportion to each other. There are some men who have a great deal of genius without having a memory, who have courage without circumspection, and who possess a metaphysical spirit without being good observers.

"Besides, the phenomena of dreaming, of somnambulism, of delirium, &c. prove to us that the internal faculties do not always act together; that there is often a very great activity of one, while the rest are not sensible.

"Thus, in old age, and sometimes in disease, such, for example as madness, several faculties are lost, while others subsist; besides a continued employment of the same faculty sensibly diminishes its energy: If we employ another, we find it has all the force of which it is susceptible; and if we return to the former faculty, it is observed that it has resumed its usual vigour. It is thus that, when fatigued with reading an abstract philosophical work, we proceed with pleasure to a poetical one, and then resume with the same attention our former occupation."

"All these phenomena prove that the faculties are distinct and independent of each other, and we are inclined to believe that the case is the same with their material organs."

"[We do not entirely agree with this idea of Dr Gall, and we believe, on the contrary, that the separation of the material organs ought to be considered as the cause of the distinction of the internal faculties. It appears, to us at least, that by supposing the faculties themselves as originally separated, we cannot save ourselves from falling into materialism, which exists when the mind is no longer considered as unity.]

"*The expansion of the organs contained in the cranium is in the direct ratio of the force of their corresponding faculties.*"

"This principle, dictated by analogy, rests on this axiom, that throughout all nature the faculties are always found to be proportioned to their relative organs; and the truth of it is proved in a special manner by the particular observations of Dr Gall.

"It is however to be remarked, that exercise has a great influence on the force of the faculties, and that an organ moderately expanded, but often exercised, can give a faculty superior to that which accompanies a very extensive organ never put in action; as we see that a man of a weak conformation acquires, by continued exercise, strength superior to another of a more athletic structure.

"[We must here mention an opinion which seems to result immediately from this principle, and which, however, is false: It is, that the volume of the brain, in general, is in the direct ratio of the energy of its faculties. Observation has proved to Dr Gall, that we cannot judge of the strength of the faculties but by the developement of the separate organs which form distinct eminences in the cranium? and that a cranium perfectly round, of whatever size it may be, is never a proof of many or of great faculties.]

"We do not recollect to have heard the reason assigned by Dr Gall; but in our opinion, these brains may be considered as in a state analogous to obesity; and as we do not judge of the muscular force of a man or an animal by the volume of their members, but by the developement of the muscles in particular, one would think we ought, in like manner, to judge of the strength of the faculties by the developement of the relative organs.

"In the last place, the 4th principle, the most important for practice in regard to the system of Dr Gall, is:

"*We may judge of these different organs, and of their faculties by the exterior form of the cranium.*

"The truth of this principle is founded upon another, viz. that the conformation of the cranium depends on that of the brain; a truth generally acknowledged, and proved by the anterior part of the brain, by the impressions in the anterior part of the cranium, and by other facts.

[There are skulls, it is true, in which an external protuberance of the bone corresponds to an interior one; and this irregularity, which is found sometimes as a disease, and most commonly at an advanced age, when the cerebral organs do not oppose the same resistance to the cranium, renders the practice of Dr Gall's system, in some measure, uncertain.]

"Guided by these principles, Dr Gall examines the nature of the skull, compares the crania of animals and those of men analogous and different in faculties. His researches have proved to him, in a manner almost incontestable, not only the above truths, but that the faculties of animals are analogous to those of man; that what we call instinct in animals is found also in the latter, such as attachment, cunning, circumspection, courage, &c.; that the quantity of the organs fixes the difference of the genus of animals, their reciprocal proportion that of individuals; that the disposition originally given to each faculty by nature may be called forth by exercise and favourable circumstances, and sometimes by disease, but that it never can be created in the case where it has not been given by nature (c); that the accumulation of the organs takes place in a constant manner from the hind part forwards, from the bottom to the top, in such a manner, that animals in proportion as they approach man in the quantity of their faculties have the superior and anterior part of the brain more expanded; and, in the last place, that in the most perfect animal, man, there are organs in the anterior and superior parts of the frontal bone, and of the parietals, destined for faculties which belong to them exclusively. It is under the latter point of view that the discoveries of Dr Gall agree perfectly with the theory of the facial angle, which seems still further to establish the truth of them."

Most of our readers will probably be satisfied with the short view which we have now given of this fanciful and visionary system; but such as wish for a fuller exposition of it, may consult the Philosophical Magazine, vol. xiv. p. 77. from which the above is extracted. We shall only add the names of a few of the organs, which the author of the system thinks he has discovered. *Organ of the tenacity of life. Organ of music. Organ of fighting. Organ of murder. Organ of cunning. Organ of arithmetic. Organ of thieving*, &c.

PHYSIOLOGY.

INTRODUCTION.

1 Definition and objects of physiology. 1. PHYSIOLOGY is that part of physical science which treats of the nature, properties, and functions of living bodies; comprehending under this term, animals and vegetables. The word is derived from φυσις, "nature," and λογος, "a discourse; and signified originally what we may call *natural knowledge*.

The object of this science is to examine and compare the phenomena of life; to discover the properties, powers, and operations of the bodies that are actuated by this principle, and to pursue the developement, progress, and decay of vital energy, from brute matter, which possesses no portion of vitality, to the most perfect animal, which seems to have it in the greatest perfection.

2 Divisions. 2. Physiology may be considered under three heads; *historical*, *philosophical* or *rational*, and *practical* physiology.

3 Historical physiology. 3. *Historical physiology* is occupied in giving a simple relation of the facts and phenomena that take place in living bodies; in bringing them together, and comparing those which succeed each other without interruption during the existence of vitality.

4 Philosophical physiology. 4. It is the business of *philosophical physiology* to consider the nature of these phenomena, and endeavour to deduce from them some general conclusions, by which they may be explained or elucidated; to draw from them natural consequences, and unfold successively their analogies and relations; to arrange, distribute, and classify them, and thus acquire sufficient *data* by which to discover the causes which produce them.

5 Practical physiology. The *practical* part of physiology is intended to point out the application of the principles of the science to the useful purposes of life, especially to medicine and agriculture. Of these divisions the first is the most important, as, until we have acquired a pretty complete knowledge of the facts relating to living beings, and arranged these in a natural manner, it cannot be expected that we should make any great progress in explaining them, or investigating their causes. From the multitude, variety, and complex nature of these phenomena, a complete view of them is extremely difficult, and requires the united efforts of genius, dexterity, patience, and discernment.

6 Relations to anatomy. Physiology is intimately related to several other departments of natural knowledge. Its relation to anatomy is the most strict and natural; and indeed the knowledge of the structure of living bodies is a necessary introduction to that of their properties and functions. So close is the union between these two sciences, that it is generally thought that the study of them should go hand in hand. Certain it is, that, without physiology, anatomy is a dry and uninteresting study; while, on the other hand, physiology, unaided by anatomy, is obscure and uncertain. It is by means of anatomy that we learn the structure and organization of the animal machine; the disposition and form of its several members; the parts that concur in the composition of them; the arrangement and the connection of these: it is by means of anatomy that we know how to estimate the advanta-

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(c) The germ of every organ must exist in embryo, if the expansion of that organ is to be afterwards called forth.

ges of any particular conformation; that we estimate the proportion between the solid and fluid parts of the body, and the adaptation of the organs to the various uses for which they are destined. But we must remember, that the aid of anatomy in physiological researches, extends no farther than to the mechanical arrangement and relation of the several parts of the body; it teaches us nothing of its intimate composition, and much less does it inform us respecting the vital powers and mental energies displayed by the living body. The most accurate inspection of the brain will afford us no light respecting the obscure function of sensation, and the hidden operation of thought and judgment; nor will the nicest dissection of the eye, or of the tongue shew us how the former is unable to convey to us the ideas of external objects, or how the latter imparts to us the thousand varied flavours of sapid bodies. In short, we may conclude, that the more the exercise of any function depends on the structure and organization of the organs that perform it, the more capable is it of illustration from anatomy.

7 chemistry, The science of chemistry has proved of eminent use in explaining several functions of the animal economy, which, without its assistance, would have been very imperfectly understood. The action of the air on the blood during respiration, and the digestion of food in the stomach, are found to depend chiefly on chemical operations; while this science has explained to us, in a most satisfactory manner, the nature, composition, and reciprocal action of the component principles of organized beings, and the nature of several changes which they undergo, both in the living and the dead state. But if we extend the application of chemistry too far, and imagine, as some of our modern chemical physiologists have done, that it is capable of explaining *life*, *motion*, and even *sensation*, we shall only betray our own presumption and our ignorance of vital phenomena. When the performance of any function depends on the intimate composition of its organs, or the combinations and decompositions that take place among their component principles; then, and then only, is it susceptible of chemical illustration.

8 mechanical philosophy, Mechanical philosophy is employed with advantage in explaining some of the phenomena that take place in living beings. The strength and solidity of the bony compages; the force and direction of the muscular motions; the propagation, direction, and mechanical effect of light, sound, odours; the effects of the gravity and elasticity of atmospheric air, and a few other circumstances, may be submitted to calculation, and illustrated on physical principles: but the laws of mechanical and of vital action are, in general, so different, and even the most mechanical phenomena of living beings are often so modified and counteracted by the agency of the vital powers, that, on the whole, we must consider general physics as one of the least useful auxiliaries of physiological researches.

9 metaphysics, Of all the branches of physical science, physiology certainly makes the nearest approach to the region of metaphysics; but yet there is a difference between these, though it may not be very easy to point out the precise line of termination. Physiology, as already defined, being that science which has for its object the organical economy of living bodies, the word organical, we think, here should mark the distinction.

Whenever the economy of living bodies indicates design, and cannot result from any combination or structure of organs, it must be supposed the effect of something different from matter, and whose explanation belongs to that science which is called *metaphysics*, or which we might term the *philosophy of the mind*. By ascribing, indeed, to the glandular contents within the cranium, and to that fiction animal spirits, the motives of action, the superficial and ill-informed may have been led to an opinion that perception, memory, and imagination, are the functions of the *cerebrum*, the *medulla oblongata*, and *cerebellum*; that the soul is a consequence of organization; and the science which treats of it only a particular branch of physiology. But mind and its faculties are now so well understood and investigated, that this opinion can seldom prevail but where penetration is not remarkable for its acuteness, or where reflection, reading, and research, have long been confined within the limits of a narrow circle.

Some metaphysical physiologists contend, that every living system of organs supposes mind, and indeed in the study of such systems the physiologist must often meet with many phenomena that are less singular than simple perception, and yet for which he cannot account by any knowledge he possesses of organic powers. This truth we partly acknowledge, when, like ancient Athens erecting her altars to unknown gods, we retreat to those asylums of ignorance, the *vis insita*, the *vis nervea*, the *vis vitalis*, the *vis medicatrix*, and a number of others of the same kind.

10 and natural history. Physiology, in the general sense in which we have defined it, is a science that investigates the nature and the functions of all living beings. It is, therefore, reasonable to suppose that it must have an intimate connection with natural history, and in fact, it is to this branch of physics that it has been perhaps more indebted than to any other. A comparative view of the various gradations among organized beings has taught us to appreciate the value of the several functions that characterise vitality, and has shewn us, that in proportion as the structure is more complex, the functions are more numerous, and more complete. Repeated observations, and multiplied experiments on various tribes of animated nature have cleared up many doubtful and obscure phenomena in the economy of man, and a continuation of this truly philosophical method of research promises to place physiology on the solid basis of experience, and enable us to reason, where only we can reason with safety, by a deduction from facts. The more numerous these facts, and the more complete their arrangement, the more extensive and the more secure will be the foundation which they afford for physiological conclusions. In short, (to use the language of Dumas, who has illustrated this relation at great length), " the physiologist who is conversant with natural history, is so much the better fortified against uncertain opinions, inasmuch as he has more fully observed the operations of nature in connection and in detail. An hypothesis which to others appears perfectly adequate to the object in view, is not convincing to him. He rises above the particular object to which it is accommodated, in order to appreciate its value; and it is often among circumstances which are foreign to the original subject, that he seeks for exceptions or contradictions that overturn the hypothesis. Every thing that may serve to complete the

knowledge of the animal economy enters into his plan; and as the nature of man is so much the less incomprehensible as we employ a greater number of comparative ideas in its exposition, it is doubtless in the power of natural history to elucidate that subject, by revealing a multitude of unknown relations between man and those beings which resemble or which differ from him *."

11
Importance and utility of physiology.

The importance and utility of physiology will scarcely be questioned, and need therefore but little illustration. To all who desire to become acquainted with the operations that take place in the animal economy, or to trace the progress of vegetation, and examine the various changes produced on the seed or bud from the action of air, heat, and moisture, (and what studies can be more deserving of a rational and an enlightened mind?) physiology must afford the most interesting subjects of contemplation. To the anatomist and the botanist, it relieves the tedium of dry description and severe classification; to the physician it holds out the surest lights to direct his researches into the circumstances that are favourable to life and health, into the nature and phenomena of death, and of course, the means of avoiding or delaying its attack; to the agriculturist it furnishes some of the most certain principles to direct him (with the aid of chemistry) in the choice of soils and the application of manures; while to the genuine naturalist, no subject presents such a field of amusement and instruction. When it shall have been rendered as complete as the state of contemporary science will allow, it will exhibit the general result of all those experiments and observations that have purposely been made to illustrate the phenomena of animated matter, or have accidentally contributed to that illustration; and when it shall reach that summit of perfection to which the efforts of genius may carry it, it may diffuse a light, of which at the present day we can form no just or adequate conception. On many occasions it may introduce order for confusion, certainty for doubt; and may establish science, in various departments that are now occupied by fancy and conjecture.

After having pointed out the *nature*, *divisions*, *relations*, and *utility* of physiology, it may not be improper to make a few remarks on the best methods of pursuing the study of it, and the works that are most worthy of a perusal.

12
Methods of studying physiology.

From what has been said of the relations between physiology and other sciences, it will be inferred that the student of our present subject should come prepared with a moderate share of knowledge in anatomy, both human and comparative, of chemistry, of mechanical philosophy, especially dynamics, optics, pneumatics, and acoustics; and natural history, especially zoology and botany. At least the *rudiments* of these branches should be well understood, and the student will then have laid a foundation on which to raise a firm and durable superstructure.

He has now to make himself acquainted with what is already known; and in this inquiry it is of much consequence that he should select those works that embrace the whole subject, without being too diffuse on the one hand or too brief and general on the other. The *Elementa Physiologiæ* of Haller contains a mass of information that will ever render it valuable as a book of reference, though it will scarcely at the present day be studied as a system of physiology. His *Primæ Lineæ Physiologiæ*, though first written, is chiefly a compendium of the larger work, and is better adapted to the general student, though, from its not containing the later discoveries in the science, it is far from complete. The *Institutiones Physiologiæ* of Blumenbach is a useful work, though it has now given place to the later and more accurate publications of Cuvier and Dumas. The *Anatomie Comparée* of the former writer contains an excellent digest of comparative physiology, and the preliminary observations prefixed to the anatomical details contained in this work, may be read with considerable advantage. Probably, however, the *Principes de Physiologie* of Dumas is the most perfect and scientific modern production that has appeared on the subject. We cannot say so much of the *Elements of Physiology* lately published by Richerand, and translated into English by Mr Kerrison; for although it contains considerable information, and a great display of reading, and even of original observation and experiment, it is neither scientific nor always very accurate. The works of Bichat, especially his *Anatomie Generale*, *Anatomie Descriptive*, and his *Recherches Physiologiques sur la Vie et la Mort*, abound with excellent physiological remarks, and, allowing for the great extent to which he has carried some peculiar doctrines, are among the best that have appeared on the animal economy.

In our own country, we have many valuable treatises and papers on different parts of physiology, and the names of Hunter, Monro, Home, Cooper, Abernethy, Carlisle, Sanders, Barclay, Jones, and many others, will ever reflect honour on the country and on the age in which they lived. We can scarcely, however, point out a complete work in our language on the general subject of physiology, though we doubt not that many will be disposed to consider the *Zoonomia* of Dr Darwin as entitled to that appellation. We allow that this is a stupendous monument of the genius and industry of its author, and it contains an ample store of valuable facts, which, if they could be divested of the hypothesis with which they are so much blended, would be extremely useful to the cause of physiological science. At present many of them tend to mislead, by a shew of metaphysical acuteness, and by the new sense in which several terms are employed. Another of Dr Darwin's works, not less valuable, in a physiological point of view, is his *Phytologia*, in which he treats of the economy of vegetation with ability and success.

13
Means of advancing and improving physiology.

He who is desirous of advancing and improving the science of physiology, must, in the first place, have recourse to a patient, and, as far as may be, an accurate observation of the phenomena that take place in organized beings; but the multitude, the variety, and complicated nature of these phenomena, place in his way obstacles that it is difficult to surmount. It is only through time, and patience, and assiduity, that he can attain his object; and it requires considerable dexterity and acuteness to detect the appearances under which these phenomena sometimes present themselves, to pierce through the obscurity in which they are often involved, and to avoid, in a route so uncertain, both the illusions of sense and the errors of genius. The living body has properties peculiar to itself, while it also possesses others that are common to it with brute matter. The phenomena by which it manifests these two orders of properties, are therefore of two kinds, as they relate particularly to the state of vitality, and as they are found in every object that exists. These latter are subject to the general laws of matter, are confounded with the phenomena of universal nature, and may be denominated *physical phenomena*. Among the former, some are confined to the arrangement or disposition of the parts in organs, and depend on the structure or form of these organs. These may be called *organic phenomena*. Others depend on the particular laws that govern vital beings, and are not the result of any peculiar organization; these are *vital phenomena*.

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* *Dumas Principes de Physiologie*, tom. i. p. 231.

14 Observation.

Observation alone is sufficient to indicate the presence or the existence of these phenomena; but to unveil them fully there is required an unceasing attention, that is resolved to pursue them through the changes produced by age, sex, climate, situation, and all those circumstances that can affect the living system.

15 Experiment.

To observation, he must add, wherever this can be done with a chance of accuracy, a patient investigation of nature by experiment. From the experiments of Spallanzani and Stevens on digestion; of Goodwin, Menzies, Spallanzani, and Davy on respiration; of Monro, Galvani, Volta, and a hundred others on animal irritability, with many other experiments made both at home and abroad, more light has been thrown on the economy of living bodies, than by all the hypotheses and theories that the most ingenious speculatists have contrived since the first dawn of infant science.

16 Cautions.

In following out Bacon's great plan of observation and experiment, we must, however, take care in physiological, as in all other physical inquiries, not to be too hasty in our conclusions, and not to suppose that we have reached the bottom of the well of truth, when we have barely got within its verge. Further observations on this subject are unnecessary here, as we have already treated it at some length in the articles PHILOSOPHY and PHYSICS.

17 Modern arrangements.

We shall conclude these introductory remarks with a brief sketch of the principal arrangements of modern physiologists, and a tabular outline of the subject as we propose to treat it in the following pages.

18 Two modes of arrangement.

There are two modes of arrangement that have usually been adopted in treating physiology; one according to the order of the functions, and another according to that of the organs by which these are performed. The latter of these was adopted by Haller; the former is that of Dumas, Cuvier, and most of our later physiologists.

19 Arrangement of Dumas.

Dumas, after a long introductory discourse, in which he treats of the best method of pursuing the study of anatomy and physiology, divides his subject into six parts. In the first of these he offers some general views respecting anatomy, physiology, and all the branches of physics which are employed in illustrating the nature and properties of organized and living beings. In this part he gives a compendious history of the progressive improvements in anatomy and physiology, points out the relations that take place between these sciences, and the auxiliary branches of mathematics, mechanical philosophy, chemistry, and natural history; he considers the principal differences that distinguish organized from inorganic matter; the nature, effects, and duration of life, and of the general and particular powers or faculties of nature, both in living and brute matter.

In the second part he lays down the fundamental principles on which the physical constitution and particular economy of man depend; treats of man considered individually; of his formation, structure, and varieties; of the modifications produced in the nature of man by age, sex, habit, and temperament; of the relations between man and external objects; of the action and reaction of the organic systems on each other; of the organic structure of man, and of its several varieties in the different parts and organs; of the natural composition of the different fluids and solids of the human body: and gives a methodical division of the functions, with a critical examination of the modes of classification commonly received.

In the third part he treats of the phenomena of the animal economy, in the relation which they bear to the perpetual commerce established between man and the organs that surround him, or of *sensation* and *motion*. Here he considers the action of external objects upon man, whence result the phenomena of sensation, and the action of man on external objects, from which arise the phenomena of motion.

In the fourth part he treats of the phenomena of the animal economy, in the relation which they bear to the consistence of the fluids, the cohesion of its solids, and the temperature of the whole system. Here he considers the mutual action between the vessels and the blood, from which result, both in the solids and fluids, that degree of cohesion and pliability that favours the necessary expansibility of the living body, or the function of circulation; the action of the air, and of caloric, on the solids and fluids, from which results the degree of expansion necessary to life, or the function of respiration.

In the fifth part he treats of the phenomena of the animal economy in the relation which they bear to the healthy and entire state of the material substance and composition of the body. Here he considers the action of alimentary substances on the human body, in repairing its loss, and preserving its substance, from which result the phenomena of digestion, absorption, and nutrition; and of the action of certain organs on the fluids of the body, in separating those which do not serve the purposes of nutrition, from which result the phenomena of secretion and excretion.

In the sixth and last part, he treats of the phenomena of the animal economy in the relation which they bear to the commerce established between the individual and the species. Here he considers the mutual physical action of the two sexes, from which arise the phenomena of generation; and the mutual moral action of several individuals, from which result the phenomena of speech, and mutual intelligence.

From this sketch of the arrangement of Dumas it will be seen, that although he takes a very extensive view of the subject, his observations are chiefly confined to the human body.

20 Arrangement of Cuvier.

Though the lectures of Cuvier do not contain a complete system of physiology, the anatomical matter in them is, however, so much blended with observations on the animal economy, that it will be of importance for the physiological student to be acquainted with his arrangement.

The whole work is divided into 30 lectures: the first of which is occupied with preliminary observations on the animal economy, comprehending a general view of the functions of animal bodies; a general idea of the organs of which the animal body is composed; a view of the principal differences exhibited by these organs, and of the relations which exist among those variations, together with a division of animals founded on their organization. The second lecture treats of the organs of motion in general; the third, fourth, fifth, and sixth lectures are merely anatomical, exhibiting a comparative view of these organs in the several classes of animals. The seventh lecture is strictly physiological, and treats of the organs of motion considered in the several actions of standing, walking, seizing and climbing, leaping, swimming, and flying.

The eighth, ninth, tenth, eleventh, twelfth, thirteenth, fourteenth, and fifteenth lectures, are occupied in considering the anatomy and physiology of the function of sensation. Of these, part of the ninth treats of the nervous system in general, and of its action; part of the twelfth gives the physiology of vision; part of the thirteenth, that of hearing; part of the fourteenth, that of touch; and part of the fifteenth, that of smell and taste.

The sixteenth, seventeenth, eighteenth, nineteenth, twentieth, and twenty-first lectures treat of the organs and phenomena of digestion, mastication, insalivation, and deglutition. The twenty-second lecture treats of what have been called the assistant chylopoietic viscera, namely, the liver, the pancreas, the spleen, and their offices. The twenty-fourth treats of the organs and phenomena of circulation in general; the twenty-sixth of those of respiration in general; the twenty-eighth of the organs of voice.

The twenty-ninth treats of the organs and phenomena of generation, and the thirtieth, of those of excretion, comprehending a general view, both of secretion and excretion.

21 Of Bichat. Subjoined to Bichat's introduction to his *Anatomie Generale*, there is a tabular view of physiology, in which, after some preliminary outline of the general structure of the organs and of the phenomena of vitality, he divides the functions into classes, orders, and genera.

The first class consists of the functions that relate to the individual; the first order of which, comprising the functions of *animal life*, comprehends five genera, viz. *sensations*, *cerebral functions*, *locomotion*, *voice*, and *nervous transmission*, besides *sleep*. The second order of this class contains the functions of *organic life*, and comprehends eight genera, viz. *digestion*, *respiration*, *circulation*, *exhalation*, *absorption*, *secretion*, *nutrition*, and *calorification*.

The second class contains the functions that relate to the species in general, and is divided into three orders. The first of these, comprising the functions peculiar to the male, comprehends only one genus, viz. the *production of the seminal fluid*. The second comprises the functions peculiar to the female, and contains three genera, viz. *menstruation*, *the production of milk*, and of *the female generative fluids*. The third order comprises the functions that relate to the union of the two sexes, and the product of that union; and it comprehends also three genera, viz. *generation*, *gestation*, and *delivery*.

Respecting the peculiar doctrines of this writer we shall speak hereafter.

22 Zoological arrangement. There is still another mode of arranging the phenomena of living bodies, that deserves to be noticed, namely, that in which they are arranged according to the artificial systems of natural history. This mode of arrangement, though of infinite advantage to the zoologist, by showing him at once the extent of his subject, and giving to his memory a power of recollection which it could not otherwise possess, is yet not such as the physiologist would wish to be observed. Zoological arrangements are useful chiefly as they facilitate the study of the manners, dispositions, and habits of different animals; and all that part of the outward economy which indicates something of the wisdom and design displayed by the Creator, in their structure and adaptation to the modes of life which they are intended to pursue; but they do not sufficiently illustrate the internal structure on which this outward economy depends, nor do they sufficiently explain the more secret functions, which being independent of the will of the creature, only display the power and omniscience of him who made it. This will be readily conceived from considering the difference between zoology and physiology, as we have defined it. Zoology is chiefly led to examine the animal kingdom as it usually presents itself to the eye, including a great variety of objects; physiology examines only that part of the animal economy which is principally made known by anatomy and chemistry. Zoology has been accustomed to divide its kingdom into so many classes or orders of animals; physiology would naturally divide its economy into so many functions. Zoology has usually subdivided its classes by certain obvious external marks, as the teeth and claws; physiology would naturally subdivide its functions by the varieties of those organs which are destined to perform them, as the several kinds of lungs and stomachs. Zoology mentions the functions only in a cursory manner, as forming a part of the history of animals; physiology takes notice of animals, only when they are of use to illustrate the functions. To these differences we may add another; that physiology, in the extended sense which we have given it, goes beyond zoology in comprehending the economy of the vegetable creation. From this comparison it will be admitted, that things which are primary in a zoological method, will often be secondary in a physiological arrangement, and *vice versa*. This is very conspicuously the case in one of the grand divisions of Linnæus, viz. mammalia, where the important secretory organs of the milky fluid are noticed only like the colour of the hair, or the length of the tail, as a good outward mark of distinction, and likewise in the excellent table by D'Aubenton in his introductory view of natural history, in the *Encyclopédie Methodique*, in which the function of digestion is not even mentioned.

23 Utility of the application of physiological to zoological arrangement. It is, however, extremely useful, both to the naturalist and physiologist, that the arrangements of both sciences should be, as far as possible, adapted to each other, by marking the relative importance of the several functions in the various classes of living beings. This has been very ably performed by Vicq d'Azyr, a modification of whose table has been given in the comparative part of our ANATOMY. See Vol. II. p. 280.

24 With respect to all physiological arrangements we may observe, that as the phenomena of living beings are so intimately dependent on each other, as to form the links of one continued chain, it is of little consequence which of the functions or phenomena we make the point from which we set out in our examination. But as the organs of sensation in most animals, and those of diges-

tion in almost all living creatures, are among the first that are evolved, it appears most convenient to begin with one of these. The following is the arrangement that we shall adopt in the present article.

25
Arrangement of the present article.

After giving a sketch of the progress of physiological discoveries and opinions, we shall divide the remaining part of the article into 16 chapters. In the first of these we shall treat of the characteristic marks, general phenomena, duration, and principle of life. In the second we shall consider the phenomena of sensation, the action of the nervous system, and the external senses of feeling, tasting, smelling, hearing, and sight. In the third and fourth chapters we shall treat of irritability, and the phenomena of motion. In the fifth we shall treat of digestion; in the sixth of absorption; in the seventh of circulation; in the eighth of respiration and voice; and in the ninth of nutrition, as completed by the successive performance of the four preceding functions. In the tenth chapter we shall treat of the phenomena of secretion; and in the eleventh, of those of excretion. In the twelfth we shall consider the various means by which living beings defend themselves from external injury, or the phenomena that attend the evolution and change of the integuments, to which function we shall give the name of *integumation*. In the thirteenth chapter we shall consider the transformations that take place in some tribes of living beings, especially insects and reptiles. In the fourteenth we shall briefly examine the phenomena of reproduction, and the hypotheses to which they have given birth. In the fifteenth we shall consider the nature of sleep, and the phenomena of dreams; and in the sixteenth we shall terminate our inquiries by a few observations on the nature and phenomena of death.

The following table is intended to exhibit an outline of the principal circumstances attending the phenomena of life, in the order in which we have enumerated them.

26
Tabular outline.

1. LIFE—is either
    - Universally diffused through the body. *Polypi*, &c.
    - Most concentrated in certain organs.
    - Continued for only a few hours. *Ephemeræ, and some other insects.*
    - ———— about a year. *Annual plants.*
    - ———— two years. *Biennial plants.*
    - ———— several years. *Perennial plants, and most animals.*
    - ———— about a century. *Elephants, pikes*, &c.
    - ———— several centuries. *Oaks, chesnuts*, &c.

2. SENSIBILITY—Appears to
    - Exist in a very low degree in plants. *Sensitivity.*
    - Exists in a greater or less degree in all animals.
    - Confined to the senses of feeling and taste. *Most zoophytes.*
    - Extended besides these to the senses of smelling, sight, and hearing.
    - Appears farther extended by an additional sense. *Bats.*

3. IRRITABILITY—Affected by
    - Stimulants invisible.
    - ———— unknown.
    - ———— unthought of.
    - The nervous influence.
    - Light.
    - Heat.
    - Moisture.
    - Electricity.
    - Salts.
    - Gases.
    - Bodies that act mechanically.

4. MOTION—Performed by
    - Legs.
    - Wings.
    - Fins.
    - The tail.
    - Organs which fall not properly under these descriptions, *bats, flying opossums*, &c.
    - The springiness of the body or of some part of it, *maggots, fleas*, &c.
    - Contrivances which fit living bodies for being moved by foreign agents.

5. DIGESTION—

5. DIGESTION—
Performed by an alimentary canal.

Without teeth.
With teeth in the mouth.
———— in the stomach.
—— stones or artificial teeth in the stomach.
—— glands in the mouth for secreting a liquor to be mixed with the food.
—— pouches in the mouth where the food is kept and moistened.
—— a sac or bag where the food is kept and moistened.
—— a membranous stomach.
—— a muscular stomach.
—— an intermediate stomach.
Without a cœcum or blind gut.
With a cœcum.
—— two cœca.
—— three cœca.
—— four cœca.
These parts, as well as ruminating stomachs and their œsophagus, have antiperistaltic motions.
—— one entrance or mouth.
—— many entrances by absorbents.
Plants have many alimentary canals.
Some polypes have alimentary canals that branch through the body.
The alimentary canals of plants and worms distribute the fluids without the aid of a circulating system.

6. ABSORPTION—
Performed by

Vessels beginning from the alimentary canal.
———————— the cavities.
———————— the surface.
Veins in the penis and placenta.
Re-absorbents originating from all the parts of the system.

7. CIRCULATION—
Performed by a system with

One heart.
A heart for distributing the blood through the respiratory organs, and an artery for distributing it through the system.
One heart for the respiratory organs, and one for the system, both in one capsule.
Two hearts for the respiratory organs, and one for the system.
A pulmonary heart, or a heart for the respiratory organs in the course of circulation.
A pulmonary heart within or without the course of circulation at pleasure.
A heart situated in the breast.
———— near to the head.
———— in the opposite extremity.
Some animals and all plants have no circulating system.

8. RESPIRATION—
Performed by organs

Diffused through the system.
Confined to one place.
Situated externally.
—— internally.
In the course of the circulation.
Not in the course of the circulation.
Within or without the course of circulation at pleasure.
Without tracheæ.
With tracheæ ramified through the system where the respiratory organs are generally diffused.
———— not ramified through the system where the respiratory organs are confined.
———— formed by rings.
—————— by segments of rings on one side, and a membrane on the other.
—————— by contiguous rings running spirally like a screw.
———— admitting air by one entrance.
———————— by several entrances.
———— wholly concealed in the body.
———— partly projecting from the body.
—————— opening at the head.
———————— at the opposite extremity.
———————— upon one side.
—————————— both sides.

9. **Nutrition**—Food prepared by
- The alimentary canal.
- The lacteals.
- The respiratory organs.
- The circulating system.
- The cellular membrane.
- The glands.
- And by the several parts in which it becomes finally assimilated.

10. **Secretion**—Performed by
- Vessels.
- Exhaling vessels.
- Excretory organs.
- Organic pores.
- Glands.
- And by all the parts of which the system is composed.

11. **Excretion**—Excrementitious matters thrown out by
- The integuments chiefly.
- The common opening of the alimentary canal.
- Two openings of this tube.
- By the lungs and other emunctories.

12. **Integumation**—Some living bodies have integuments which are
- Scaly.
- Shelly.
- Membranous.
- Corneous.
- Cretaceous.
- Ligneous.
- Covered with down.
- ———— hair.
- ———— prickles.
- ———— feathers.
- ———— a viscid matter.
- Change their colour.
- —— their covering.
- Changed themselves.

13. **Transformation**—Takes place
- By a change of proportion among the parts.
- ———— of their form.
- — throwing off old parts.
- — an addition of new ones of a different use, structure, and form.
- — a change of the whole form together.
- ———— of qualities, propensities, manners.

14. **Generation**—Performed by
- The temporary union of two sexes.
- The spontaneous separation of parts.
- Organs situated in the breast.
- ———— in the side.
- ———— near to the head.
- ———— in the opposite extremity.
- An intrant organ of the male, and a recipient organ of the female.
- An intrant organ of the female, and a recipient organ of the male.
- The stamina and pistils of flowers.
- The seminal secretion of the male thrown into the organs of the female.
- ———— sprinkled at the entrance of the female organs.
- ———— thrown upon them from a distance.
- ———— transported to them by the winds.
- ———— sprinkled on the embryo after emission.
- ———— dissolved in a fluid secreted by the female before it can rightly perform its office.
- ———— dissolved perhaps sometimes in air, as in the case of dioicous plants, where it probably acts like an aroma.

15. **Sleep**—Natural sleep is occasioned by
- Quietness.
- The absence of stimuli.
- The sameness of stimuli when long continued.
- Deficient assimilation.
- Deficient irritability, which is owing sometimes to the weakness, inattention, or confined powers of the mental principle.

16. **Death**. See Life.

HISTORY.

HISTORY.

27 Utility of the history of physiology.

The early history of physiology can be little more than an account of the opinions of the ancient philosophers respecting the nature and functions of the human body; but as their opinions reflect considerable light on the progressive improvement of the philosophy of man, the history of physiology, even in its early stages, is curious and interesting.

28 Opinions of Pythagoras respecting man.

Of the origin of physiology as a science we know nothing. On examining the writings of the earliest philosophers, we meet with little more than a collection of abstract principles and hypothetical reasonings, especially previous to Pythagoras. He considered man as a microcosm, or an epitome of the universe, in which were produced the same phenomena as in the larger world, only to a less extent. He admitted more than one intelligent principle, conducting all the operations of the human body. He supposed that the human soul, nourished by the blood, fixed by the veins, the arteries, and the nerves, as so many visible situations, became obedient to the general laws of universal harmony. He did not pretend that the eternal power of numbers had prescribed all the phenomena of nature, and that the force of numerical harmonies regulated the motions of the bodies which filled the universe, though he has been made so to express himself by his disciples. He was contented with asserting, that every thing in nature was brought about according to the qualities and proportions of numbers, without attributing to them an intrinsic virtue and a positive existence. He perceived that the phenomena of the animal economy succeeded each other with a strict regularity, by which they concurred in maintaining order; and in this order he found the principle of the existence and preservation of all beings; a principle without which they could not exist. He considered the souls of men as emanations from the general soul of the universe, or *anima mundi*.

29 Of Alcmæon.

Alcmæon considered the brain as the seat of the soul. He supposed sound to be produced by the reverberation of the air within the cavity of the ear; and he thought that taste was owing to the moisture of the tongue. He compared the body of a fœtus to a sponge, which obtained its nourishment by the suction established over every part of its substance. According to him, the motion of the blood was the essential principle of life; and he supposed that the stagnation of this fluid in the veins produced sleep, and its active expansion brought back the waking state of the body. Health consisted in the equilibrium and well proportioned mixture of certain primary qualities; and that whenever any of these became too predominant, disease was the consequence.

30 Of Empedocles and Anaxagoras.

Empedocles involved himself in a multitude of absurd hypotheses, in order to explain the formation of man, and the combination of the elements from which he was produced. He too, like the disciples of Pythagoras, sought among the properties of numbers, for the general principles both of physical and moral science. In uniformity with this system it was, that he reckoned the four elements, and admitted among the particles of these material principles a kind of affection and aversion, of desire and antipathy, capable of separating and reuniting them, as occasion might require. He believed that respiration commenced within the *uterus*, where the infant was provided from each parent with certain organic particles, which tended to unite into one uniform whole. Anaxagoras, convinced that we must attribute the arrangement of matter to the intelligence of a superintending being, imagined that the body of every animal was formed of homogeneous particles, which were brought together by a sort of affinity. It appeared to him, that bodies which were endowed with thought, were composed of sensible elements; that these elements remained unalterable, and that no power in nature could exert any action on them.

31 Democritus.

Democritus dedicated his life to repeated experiments on plants and animals. He explained the principal phenomena of organized bodies by the action and reaction of atoms, which he supposed to be endowed with powers essentially active, and susceptible of repelling and attracting each other. According to him, generation consisted in the cohesion of homogeneous atoms. He conceived the heat inherent in the elements of the body to be the sole active principle with which man was animated; and that by increase of this he became capable of life and motion. He compared the organs of the senses to mirrors, on which were painted the images of things, and he reduced all sensations to the sense of feeling, which he supposed to be more or less delicate according to circumstances.

28 Hippocrates.

These philosophers, who lived before the time of Hippocrates, had, as we see, but very rude and indistinct notions of the animal economy; nor were those of the great father of physic much superior. Excellent as was his practice, and acute his knowledge of the symptoms and progress of diseases, the physiology of Hippocrates was very lame and defective. He seems, indeed, to have understood the functions of nutrition better than most others; he traces the aliment into the stomach, seems aware of the processes it has to undergo there, and hazards a conjecture that part of the chyle is taken up immediately by the pores of the cellular texture; and that the juices admitted into this membrane, served for the production of milk, the matter of which is afterwards transported, and laid up within the breasts. He attributes to each vital part an attractive force, which it exerts on the nutritious particles, in order to incorporate and appropriate to itself those which bear to it a certain analogy. He thought that the heat generated in a living body was kept up entirely by powers of vitality; and that the external air introduced by respiration, served rather to check it, by exerting a cooling effect on the pulmonary organs. He represents the human body as agitated in all its parts by an alternate flux and reflux, which carried the matters from within outwards, or brought them from without inwards. From this some have supposed that he understood the circulation of the blood, a supposition made two hundred years ago, and lately again brought forward by the French physiologists. We shall not at present stay to canvass this opinion, which, however, we conceive to be founded on very unsatisfactory arguments.

33 Plato.

After Hippocrates, the science of man was again left to the schools of philosophy, from which he had first separated it. Plato is the first philosopher whose opinions merit peculiar notice. He wrote on the physiology of man with his accustomed elegance and splendour of diction; and he assumed the tone of an inspired prophet in decribing, with the force of enthusiasm, the grand images that suggested themselves to his mind. According to him, the human body does not contain within itself the cause of the phenomena which are the consequence or the attendants of life. It is only a passive subject, on which the soul expresses the series of its functions, like the canvas on which the painter traces the conceptions of his inventions. He distinguishes two principles of action in man, a rational soul, on which depend reflection and intelligence, and an irrational soul, on which depend life and motion. The latter is diffused through every part of the body; and it is by means of these parts that it feels, suffers pain, or enjoys pleasure. Thus it is by means of the heart it is susceptible of courage and of passion; by the liver of desire. The head is the seat of reason; the chest, and especially the heart, the seat of strength and anger; the lungs, the general coolers of the body. One division of the irrational soul, which possesses an appetite for food, and all the necessary refreshments of the body, resides in the epigastric region; which, in the language of Plato, is a sort of stable, in which resides a voracious animal. During nutrition, the vital parts assimilate to their substance the aliments which are presented to them; and this assimilation is the consequence of an affinity that takes place between these parts and the nutritious juices. He thus seems to regard nutrition as the effect of a combat between the aliments and the parts of the animal. A young animal will receive more nourishment than one which is old, because the force of its body has more effect in overcoming the force of the nutritious substances.

As the reciprocal action of the soul and the body on each other did not appear to him capable of being explained on the supposition of immateriality, he proposed the idea of a *plastic nature*, which he supposed to be an intermediate principle connecting the soul and the body.

The human body, which is entirely spongy, is exposed through every part to opposite currents of air and fire, which traverse and penetrate it, being introduced alternately by the lungs and by the skin. Hot, cold, dense, rare, and the other sensible properties of bodies, are only the causes of the phenomena which we perceive, and are, as it were, the occasions or accidents that are required to keep in play the intelligent force disseminated through nature.

34
Aristotle.

Aristotle, the disciple of Plato, for a long time disputed with him the palm of genius and celebrity; but, as his physiological doctrines differed very little from those of his master, it is unnecessary to detail them, except to remark, that he attributed to the soul three faculties, a *nutritive*, a *sensitive*, and a *rational* faculty; in the first of which life is the only principle; in the second, feeling is produced; and the third is peculiar to man, and is that part of him which knows or judges. This part is either an active or a passive intellect, of which the first may be separated from the body, and is immortal; whereas the second perishes together with the body. Life, according to this philosopher, is a permanence of the soul, retained by the natural heat, the principle of which resides in the heart.

About the period which we are now considering, philosophy was divided into two sects; the materialists, who attributed the formation of all beings to the fortuitous concourse of atoms; and the spiritualists, who held that the soul enjoyed an existence anterior to that of the body, which was no other than a passive organ, in which the phenomena that previously existed in the soul, in an abstract, latent manner, became evident and sensible. To the former sect belonged Democritus and Epicurus; to the latter, Zeno and Plato.

35
Herophilus.

The professors of the Alexandrian school, though they did much for the improvement of anatomy, added little to physiology. Of these Herophilus brought to some degree of perfection the doctrine of the pulse, and seems to have understood the action of the pulmonary organs more correctly than his predecessors, attributing to them a sort of natural appetite, by which they attracted and rejected the matter of respiration. He considered the nerves, the muscles, and the arteries, as the moving powers of the body.

36
Galen.

In Galen, also a disciple of this school, we find the most scientific physiologist that has yet come under our notice. He seems first to have ascertained by experiment, that the arteries contain blood, and not air, as had been the opinion of Herophilus and his predecessors: and that they possessed a moving force, independent of that which the heart exercises on the mass of blood, and he found that the contraction of the heart always alternated with a proportional dilatation. He even tried some delicate experiments, in order to ascertain the influence of the nervous system upon the sensitive and motive powers of the body, by which he found, that when a nerve was intercepted with a ligature, the part to which it led became deprived of sense and motion. He believed that the stomach, in a state of contraction, applied itself to the aliment that had been taken in; that the mesenteric veins absorbed a portion of the chyle prepared in the intestines; that the *ductus choledochus* carried the bile from the gall bladder into the duodenum; that the kidneys separated a part of the urine: and he supposed, that another part of this fluid passed immediately from the stomach to the bladder, through some unknown passage. He believed that the lungs transmitted to the blood contained within them, an aerial principle, destined to free them from fuliginous vapours, and to temper the excess of heat generated within the body. The obscure function of generation did not entirely escape his researches; and he made some curious attempts to find out how the sexual organs prepared the seminal fluid, and how this acted in reproduction.

For more respecting the doctrines of Galen, see the History of MEDICINE.

37
The chemists.

The commencement of the 13th century is the epoch of a material revolution in physiology. Chemistry having penetrated into Europe, soon exerted its influence on most of the sciences, and especially on those connected with medicine, the doctrines of which were totally changed from their ancient simplicity, and became a farrago of the most wild and fanciful opinions. The Peripatetics and the Galenists sunk into oblivion; and the primitive qualities and occult faculties of the ancient school gave way to the fermentations and effervescences of the chemists. Albertus Magnus and Roger Bacon, when they introduced the science of chemistry, scarcely dreamed of applying it to medicine; but Arnoldus de Villa Nova undertook this application, and sought for the foundation of medical theory amid the processes of his laboratory. Paracelsus followed, and surpassed him in this chemical delirium. An enlightened chemist and a credulous astrologer, his head burning with the fire of his furnaces, and his imagination filled with magical reveries, he believed himself capable of construeting a new system of philosophy, from examining the course of the stars, and the products of his alembics. With the daring assurance of inspiration, he declared man to be composed of sulphur, mercury, and salt; and, having traced the origin of all diseases to certain chemical operations, he flattered himself, that by means of his arcana he could preserve health, and prolong, to an indefinite extent, the natural duration of human existence.

38 **Van Helmont.** Van Helmont, the disciple of Paracelsus, not less fanciful, but more scientific than his master, saw the necessity of something more than chemical principles to explain the functions of the animal machine. He therefore introduced his *archæus*, an intelligent being who established his throne in the epigastric region, having several subaltern ministers under him, who presided over the several functions of the body, and whose chief seats were, the head, the chest, and the belly.

39 **Des Cartes.** In the philosophy of Des Cartes, the separate existence of the vital principle is entirely rejected. He availed himself of the progress that had been made by Willis, and some other anatomists, in the investigation of the nervous system, to form an hypothesis of the vital functions, founded on the supposition of the nervous fluid, or what was then called the *animal spirits;* and this nervous fluid was assumed independently of the sensitive soul, to explain the appearances of sensation and voluntary motion.

The discovery of the valves in the veins by Fabricius; of the lymphatics by Rudbeck and Bartholin; of the lacteals by Asellius, and of the circulation of the blood by Harvey, all of which took place during the 17th century, gave to physiology an interest and a clearness which it never possessed before that period. Some account of the discoveries in the circulating and absorbing systems, hath been already given under ANATOMY; but as these discoveries have been productive of great advantages, both in general physiology, and in medicine, it will be worth while briefly to trace their origin and progress.

40 **Discovery of the circulation.** To begin with the circulation of the blood. Hippocrates speaks of the usual and constant motion of the blood, of the veins and arteries as the fountains of human nature, as the rivers that water the whole body, and which if they be dried up man dies. He says, that the blood-vessels are, for this reason, everywhere dispersed through the whole body; that they give spirits, moisture, and motion; that they all spring from one; and that this one has no beginning and no end, for where there is a circle there is no beginning. In such language was the prince of physicians accustomed to express his vague ideas of a circulation; for so far was he from having acquired accurate conceptions on this subject, that when he saw the motions of the heart, he believed that the auricles were two bellows to draw in air, and to ventilate the blood.

When after his time anatomy came to be more studied, the notions of the ancients respecting the blood were better defined; and, however chimerical they may seem to us, they were partly derived from dissection and experiment. On opening dead bodies, they found that the arteries were almost empty, and that very nearly the whole of the blood was collected in the veins, and in the right auricle and ventricle of the heart. They therefore concluded that the right ventricle was a sort of laboratory; that it attracted the blood from the cavæ; by some operation rendered it fit for the purpose of nutrition, and then returned it by the way that it came. From the almost empty state of the arteries, they were led to suppose that the right ventricle prepared air, and that this air was conveyed by the arteries to temper the heat of the several parts to which the branches of the veins were distributed.

To this last notión, entertained by Erasistratus, Galen added an important discovery. By certain experiments, he proved, that the arteries contained blood as well as the veins. But this discovery was the occasion of some embarrassment. How was the blood to get from the right to the left ventricle? To solve the difficulty in which this new discovery had involved him, he supposed that the branches of the veins and arteries anastomosed; that when the blood was carried to the lungs by the pulmonary vein, it was partly prevented by the valves from returning; that therefore during the contraction of the thorax it passed through the small inosculating branches to the pulmonary vein, and was thence conveyed along with the air to the left ventricle to flow in the aorta. This opinion, so agreeable to fact, unfortunately afterwards gave place to another that was the result of mere speculation. This notion was that the left ventricle received air by the pulmonary vein; and that all its blood was derived through pores in the septum of the heart.

The passage through the septum being once suggested, and happening to be more easily conceived than one through the lungs, it was generally supposed the only one for a number of centuries; and supported likewise, as it was thought, by Galen's authority, it was deemed blasphemy in the schools of medicine to talk of another. In 1543, however, Vesalius having published his immortal work upon the structure of the human body, and given his reasons in the sixth book why he ventured to dissent from Galen, he particularly shewed how it was impossible that the blood could pass through the septum of the heart. His reasoning roused the attention of anatomists; and every one grew eager to discover the real passage which the blood must take in going from the right to the left ventricle. The discovery of this was first made by Michael Servede, a Spanish physician, who published his opinion in 1553. He expressly says, that the blood does not pass through the septum of the heart, as is commonly believed, but is conveyed by an admirable contrivance from the right ventricle of the heart, by a long passage through the lungs. This opinion was deemed heretic, and Servede's book was suppressed by public authority. Soon after, however, the same discovery was made by Realdus Columbus, an Italian professor, who published his account in 1559. It farther appears, that Andreas Cæsalpinus, who published in 1571, and again in 1593, was acquainted, not only with the lesser circulation, but observed, that the blood sometimes flowed from the branches of the veins towards their trunks; and that when a vein was tied with a ligature, it swelled between the ligature and the distant extremity of the vein, and not between the ligature and the heart. He thence inferred, that the veins and arteries opened into each other, and ventured to assert that the blood could not return by the arteries to the left ventricle of the heart. He did not, however, discover the true circulation, but most unaccountably maintained with Aristotle, of whom he was a zealous disciple, that the blood flowed like the tides of Euripus, backward and forward in the same channel, and supposed that it flowed from the arteries into the veins during sleep, and back again from the veins into the arteries till the waking state.

In 1574, Hieronymus Fabricius ab Aquapendente, while he was seeking for a cause by which to explain the various swellings of some veins, which had arisen from friction and ligature, he, to his great joy and astonishment, discovered their valves in one of his dissections; and here again the true theory of circulation seemed almost unavoidable. Yet whoever reads the small treatise De Venarum Ostiolis, first printed by Fabricius in 1603, will soon perceive that he was as far from entertaining a just notion of the circulation as his predecessors. Notwithstanding all that he saw, he still was of opinion that the blood flowed from the heart to the extremities even in the veins. He thought that the valves were intended by nature only to check and moderate its force. He calls them an instance of admirable wisdom, and mistakes his own awkward conjecture for one of the designs of infinite intelligence. In another respect, it must be confessed that he bore no inconsiderable share in promoting the discovery of the circulation. By writing on the valves, the formation of the fœtus, and chick in ovo, he directed the attention of his pupil Harvey to those subjects where it was likely that the motion of the blood would frequently occur.

Harvey, who was born in 1578, and graduated at Padua in 1602, examined the valves with more accuracy than Fabricius, and explained their use in a treatise which he published soon after his graduation. In 1616, he taught the true doctrine of the circulation in his lectures, and published on the subject in 1628. He was the first author who spoke consistently of the motion of the blood, and who, unbiassed by the doctrine of the ancients, drew rational conclusions from his experiments and observations. His books present us with many indications of a great mind, acute discernment, unwearied application, original remark, bold inquiry, and a clear, forcible, and manly reasoning; and every one who considers the surprise which his doctrine occasioned among the anatomists of those days, the strong opposition that it met with from some, and the numerous and powerful prejudices which it had to encounter from the sanction of time and of great names, must allow it was new; and that the author has from its importance, a title to rank in the first class of eminent discoverers, ancient or modern.

We have been the more particular in tracing the progressive discovery of the circulation, and in attempting to shew that the real merit of the discovery is due to Harvey, because both the abilities and the originality of this eminent man have been called in question by his countryman Dr William Hunter; and many hints are given in the writings of some foreign physiologists, that the circulation was at least guessed at by Hippocrates and other ancient writers.

We shall be less minute in tracing the discovery of the lymphatic system, because this has been related more at large in the article Anatomy.

41
Discovery of the absorbent system.

We learn from Galen, that certain vessels had been seen in kids by Erasistratus, which appear to have been lacteals, though he called them arteries. These lacteals were, however, first accurately distinguished in 1622, by Asellius, who printed his account in 1627. In 1651, Pecquet published his account of the thoracic duct, which appears, however, to have been seen before by Eustachius. In 1653, Bartholin published on the lymphatics, which had been some time before discovered by Rudbeck. In 1654, Glisson ascribed to these vessels the office of carrying back the lubricating lymph from the arteries into the blood, or considered them as absorbents. In 1664, the valves of these vessels were discovered by Swammerdam, and a year after, an account of them was given by Ruysch. The farther discoveries of Nuck, Nouges, Warton, Steno, Hunter, Monro, Hewson, Cruikshank, Sheldon, Mascagni, &c. have nearly completed our knowledge of the absorbent system, and its uses.

In the latter end of the 17th century, some important discoveries were made on the subject of respiration, by our countryman Mayow; and these were supported by the observations of Lower, Verheyen, and Borelli. These discoveries, however, lay dormant till they were brought into recollection a hundred years after in consequence of the experiments of Priestley and Lavoisier.

During the 17th century, considerable progress was made in completing the knowledge of the internal organs of generation. Much was done in this way by De Graaff and Malpighi, and Leuwenhoeck, the two latter of whom made several discoveries with the assistance of their microscopes, though Leuwenhoeck founded on his observations a theory of generation which at this day appears not a little ridiculous.

42
System of Boerhaave.

The beginning of the 18th century is remarkable for the promulgation of a new physiological doctrine, founded on a mistaken application of the circulation of the blood. We allude to the system of Boerhaave. This great physician supposed that all the functions of the living body, excepting the will, are carried on by mechanical movements, susceptible of rigid calculation, which necessarily succeed each other in the organs, from the time that life commences. These movements are brought into action as soon as the animal begins to respire, and are the consequence of an impulsive power in the heart, renewed by means of the influence of the nervous fluid brought from the brain. He conceived the living body to be merely a hydraulic machine, in which the heart performs the office of a piston, and that the alternate contractions and dilatations that take place without intermission in that organ, are owing to the alternately increased and diminished compression of the nerves that are distributed to the heart. When a contraction takes place, the blood fills the large arteries, and thus distends and compresses them; when the principal nerves of the heart, which pass between these arteries, must of course become compressed, and thus their influence being diminished, a relaxation takes place. But in proportion as the heart is relaxed, the large arteries become empty, and consequently cease to compress the nerves, which thus recovering their influence, reanimate the heart to a new contraction. Thus succeed each other without interruption the movements which form the mechanical principle of all the sensible motions that we observe in the animal machine.

History.

Proceeding on these principles, Boerhaave conceived some very strange notions respecting the constituent properties of the living fluids, in which he saw no other mark of vitality than the globular form of their particles. He confined all the functions of the several organs to the operation of rounding into spheres the particles of the fluids which are presented to them, or of preserving that form in those which they already contained. He thought that the lungs were chiefly of advantage, because they contained within them a complete series of vessels, in which the particles of the blood can receive all those dimensions which may fit them to circulate through the rest of the body. The greater or less velocity with which the fluids circulate through the secretory organs, constitutes the principal difference in the nature of the secretions. Various orders of vessels receive the blood and other fluids which pass through these divisions, subject to the laws of hydraulics; and when a fluid got by chance into an order of vessels that was not fitted to receive it, some disease was the consequence. Every thing in the animal machine was reduced to an assemblage of conduits, canals, cords, levers, pulleys, and other mechanical contrivances, put into action by mechanical means.

43 Mechanists.

Thus was completed the system of mechanical physiology, which was begun some time before by Bellini and Borelli; and this system maintained its ground in defiance of observation and common sense, till about the middle of the 18th century. In the mean time, however, there arose two men, whose enlarged ideas and acute genius induced them to dissent from the received opinions of the day, and to think for themselves. These were Hoffman and Stahl, who, though they did not, any more than Boerhaave, form complete or unobjectionable theories, contributed much to improve our ideas of the animal economy.

44 System of Hoffman.

Hoffman saw, that in the living body we ought not to separate the principle of vitality from the general properties of matter. He believed that that principle, susceptible in itself of activity and motion, was sufficient for all the occasions and all the functions of the body which it animated. The animal body was not, in his eyes, an hydraulical elastic machine, formed of solids and canals, differing only in size, form, elasticity and force. He saw, that if the solids act upon the fluids, these must, in their turn, react upon the solids; and that life could subsist only by these mutual actions and reactions. The essential cause of life, according to Hoffman, is the progressive motion of the blood, occasioned by the impulse of the heart. and kept up by the alternate contractions and dilatations of the vessels. These contractions and dilatations are the consequence of the force of an elasticity inherent in the vascular fibres, and this force is still farther promoted by the different structure of these elastic fibres, which is such that they can be penetrated by the blood and the nervous fluid. This last fluid he imagined to be composed of aerial and etherial particles enveloped in a certain portion of a very pure subtile lymph, that served them as a vehicle. By this fluid the cavities of the nerves are filled, and it constitutes the sensitive soul, in which resides the seat of the passions. Now, all the functions. even those which we attribute to the sentient principle, are the effect of physical powers, whose mechanism has, however, something more sublime and more exalted with respect to the animal operations than to others. If all the nervous, vascular, and membranous parts, preserve a moderate degree of action, and a moderate state of tension and relaxation, the solids are subjected to oscillatory motions which balance each other, and produce a proper equilibrium in the system. In this state, all the operations of the body and the mind take place with proper regularity; and this happy harmony, ~~by assur~~ing to the animal the entire plenitude of its existence, becomes the foundation of health. This degree of moderate tension is always more or less altered in a state of disease.

45 Of Stahl.

Little satisfied with all the theories founded on a gross mechanism, and convinced of their insufficiency to explain the phenomena of vitality, Stahl admitted forces that were something more than mechanical, and that were directed by an intelligent principle which applies them to their destined uses, and which, by distributing them with a wise economy, poportions or accommodates them to the different occasions of the individual. His disciples consider Stahl as the first modern writer who has treated the science of man on a general plan, and according to a philosophical arrangement; and as his doctrine has still numerous advocates in the medical schools of France, we shall be somewhat more particular on it than on that of Hoffman.

In determining the limits between medicine and the other physical sciences, Stahl commences with separating from the former all those principles which, though true in themselves, have no relation to the nature of that science, which he considers as originating in observation alone. The knowledge of the physical state of the animal body cannot, he thinks, throw any light, either on the injuries to which it is exposed, or on the means of preventing or removing them. Consequently it is of little use in medicine, and has no right to govern an art, the object of which is, to remedy those injuries that threaten the human body. He proves that living bodies are freed from the necessary laws of mechanics, because all their actions tend to one common end;—an end which embraces the whole chain of the movements essential to life, and the means established for its preservation. The human body, by means of this mixture of mechanical and vital powers, tends naturally to self-destruction; but, on the other hand, the organic structure to which is attached the exercise of the actions peculiar to the human species, is founded on this mixture. It is therefore necessary that the body should be in a state of resisting this tendency, in order that it may be sustained; and as the corruptibility inherent in its nature, pursues it through every period of its existence, the opposing action necessary to prevent the corruption from taking place, must also be exercised without intermission. It is this preserving action that constitutes the essence of life.

The preservation of the body is indeed effected by a sort of mechanical action; it requires the corporeal organs as its instruments, and it depends on different coexistent and successive actions. Health is the result of that just conformation of the organs which enables them to perform their functions with ease.

The exact conformity which subsists between the structure of each organ, and the functions it is destined to perform, demonstrates to the philosophical eye an intelligent and wise principle, that in the formation of organized bodies directs and prescribes every thing in the manner most favourable to the end which it proposes. A speculative metaphysician, accustomed to wander over the field of abstraction, to enlarge the sphere of his intellectual notions, to transform sensible objects into ideas, this author could never persuade himself that a being could not proportion and adapt its organs to the operations they are to perform, without possessing a knowledge of these operations, and having already exercised a judgment with respect to them. It is from this that he confounds the principle of life with the thinking soul, which being incessantly present in every part of the body, directs and disposes them according to its own views, and to the end that it proposes in the continual developement of the actions it is to conduct.

The formation, the structure, duration and movements of the body, do not belong peculiarly to it, as it is only a passive subject on which the soul impresses and realises the idea of the phenomena that she has conceived. Every thing is derived from the union of the body with the active foreseeing principle, which governs, according to special laws, those phenomena which are more particularly vital, and which are most independent of the will. The immediate action of this latter faculty does not require the assistance of any other substance. The intervention of an intermediate principle would be there superfluous; and Stahl rejects that of the animal spirits, which had been introduced to explain the mechanism of vitality, and which, by overcharging the science, embarrasses it with a useless hypothesis.

Two faculties are sufficient for the soul to act upon the body, and to preserve it in a living state, viz. those of sense and motion. By the former the animal learns to know the properties of the objects by which he is surrounded, or in which he is interested, and to estimate the relations that subsist between these objects and himself; the latter produces the motion of the whole machine, and determines all the changes of situation which it has to undergo in its whole, and in its parts.

The faculty of sensation has two modifications, relative to the two kinds of knowledge which the soul may receive by means of that function. The first of these resides in the organs of sense, and is adapted to external objects; the second establishes its seat in the interior organs, and refers to objects that are within, or ideas. Sometimes the moving power enveloped in the muscular system is displayed by the sensible actions that regulate the position of the body with respect to the objects of the universe, of which it makes a part; sometimes concentrated within these organs, it excites intestinal motions, which maintain among their constituent parts, those relations, and that equilibrium, which are necessary to preserve the healthy state, consistence, and tone of each organ. The muscular apparatus is subservient to the exercise of the senses; and the different motions which it impresses on the body, for the purpose of transporting it towards, or to a distance from, certain objects, are always determined by the convenience or inconvenience which the body, by means of the senses, experiences from those objects. The tonic motion, determined by the confused ideas of the principle of life, is displayed in the most hidden organic parts, in the most perfect repose and profound silence of the voluntary movements.

The soul gives to its organs the disposition that is favourable to the sensations it wishes to receive, by virtue of the judgment that it exerts respecting these sensations, before it has experienced them. This judgment is exerted on the relations between the objects that excite these impressions, and the actual state of the body; and it is the intuitive knowledge of these relations that determines, in all their infinitely diversified shades, the pleasure or the pain which the animal experiences from the objects that surround it.

Stahl regards the excretions as the means employed by nature to counteract the natural tendency of the body towards putrefaction. He believes that the animal humours are exceedingly disposed to thicken, and that the circulation of the blood is the means made use of by nature to keep up their original fluidity. One of the causes that most favour the tendency of the humours to putrefaction, is *plethora*, to which nature opposes, sometimes the motion of the solids that distribute the blood; sometimes the hemorrhagic fluxes which unload the vascular system. These latter opinions are the principal foundations of what has been called the *humoral pathology*, which prevailed so long in most of our medical schools, and which, with certain modifications, is still maintained in many parts of the continent.

46 Of Haller.

The favourable impulse given to physical science in general, by the philosophical writings of Bacon and Newton, extended itself at length to physiology; and physiological writers became convinced that it was better to collect and arrange the facts that related to the economy of living beings, than to frame hypothetical systems concerning them. The honour of forming a rational digest of the phenomena of the animal economy was reserved for Haller, who perceived the importance of assembling under one view, the experiments, facts, and observations of preceding writers, and of substituting them in the place of hypothetical reasonings. He traced the plan of the immense edifice that he designed to construct in his *First Lines of Physiology*, and executed it on a grand and extensive scale, in his *Elements*, in which he has brought together into a body of doctrine, as complete as could be expected in his time, all the materials of the science. He perceived the inconvenience of a too strict application of the laws of mechanical philosophy to the living system. He admitted an active force, which he considered as peculiar to the animal body, viz. irritability, which contains the reason or the experimental cause of muscular motion. He maintained that irritability should never be confounded with sensibility, and that the irritable fibre differs as much from the sensible fibre, as the function of motion from that of sensation. Lastly, in his *Opera Minora*, he lays down many new and important points of doctrine respecting the structure of our organs, and the mechanism of our functions; and he relates a number of experiments made on living animals, for the purpose of drawing from nature the secret of those phenomena which she appears most desirous to conceal. We owe to Haller some curious researches respecting the formation of bone, and the production of callus, as well as some important elucidations of the manner in which the embryo contained in the egg is developed, and passes through the successive stages of its organization. He has left us many experiments and details respecting the structure of the heart, the circulation of the blood, and the pulsation of the arteries; on the mechanism of the ribs, and the action of the intercostal muscles during respiration; on the differences between the sensible and irritable organs; on the action of the brain and nerves, &c.

The latter half of the 18th century is remarkable for many able physiologists, who will be admired by posterity, either for the acuteness of their genius, or the important improvements that they have made in the science. We may mention the names of Bordeu, La Caze, Bonnet, Vicq d'Azyr, Bichat, Dumas, and Cuvier in France; of Fontana and Spallanzani in Italy, and of Whytt, Cullen, Brown, and Darwin in Britain. We cannot pretend to enumerate all the opinions and discoveries of these celebrated men, but must content ourselves with giving a sketch of the three rival systems of Cullen, Brown, and Darwin, and a brief outline of the opinions of Bichat.

47 Of Cullen. The physiological system of Cullen was founded chiefly on that of Hoffman. He placed the principle of the whole animal economy in the movement of the vital solids, regulated by the fundamental laws of the nervous system. This notion of the vital solids, according to him, originates in the nerves, and being almost always united in the *sensorium*, is easily transmitted from one nervous part to another, as long as the medullary substance of the nerves continues in its natural state of life and continuity. The contraction of the moving fibres connected with the sensible organs through the medium of the brain, is the direct effect of a movement that commences with those objects. It is on the contractility inherent in the moving fibres, excited by their own extension, by the application of various stimuli, and often by the immediate influence of the animal or nervous powers, that all the physical actions of a living being depend. He regards this contractile force as distinct from all those which are possessed by the simple solid, and the inorganic elastic parts of the body.

Of the theory of Brown, we have given a sufficient detail under his life, and need not repeat it here.

48 Of Darwin. It is not easy to give a compendious view of the system of Dr Darwin, that shall be intelligible to those who have not examined his celebrated work, the Zoonomia; but we shall endeavour to give as brief and perspicuous an account of it as possible. It is necessary first to notice the descriptions given of the terms to be employed, which are as follows.

The immediate organs of sense are, by Dr Darwin, asserted to consist, like the muscles, of moving fibres. The contractions of the muscles and of the organs of sense, are comprehended under what are called *fibrous motions*, in contradistinction to the *sensorial motions*, or the changes which occasionally take place in the *sensorium*. By this latter term is understood, not only the *medulla* of the brain and nerves, but also at the same time that living principle or *spirit of animation*, which resides throughout the body, and which we perceive only in its effects. An idea is defined to be a motion of the fibres of some immediate organ of sense; and hence is frequently termed also a *sensual motion*. Perception comprehends both the fibrous motion or idea, and the attention to it. When the pain or pleasure arising from this motion and this attention produces other fibrous motion, it is termed *sensation*; thus limiting this term to an active sense. Ideas, not immediately excited by external objects, but which recur without them, are termed either, 1. Ideas of *recollection*, as when we will to repeat the alphabet backwards; or 2. Ideas of *suggestion*, as when we repeat it forwards, A suggesting B, B suggesting C, &c. from habit.

After mentioning a number of experiments to prove the fibrous motions of the organs of sense, Dr Darwin proceeds to lay down the following laws of animal causation.

1. The fibres which constitute the muscles, and organs of sense, possess a power of contraction. The circumstances attending the exertion of this power of *contraction* constitute the laws of *animal* motion, as the circumstances attending the exertion of the power of attraction constitute the laws of *inanimate* matter.

2. The *spirit of animation* is the *immediate* cause of the contraction of animal fibres. It resides in the brain and nerves, and is liable to general or *partial* diminution or accumulation.

3. The stimulus of bodies external to the moving organ is the *remote* cause of the original contractions of animal fibres.

4. A certain quantity of stimulus produces *irritation*, which is an exertion of the spirit of animation exciting the fibres to contraction.

5. A certain quantity of contraction of animal fibres, if it be perceived at all, produces *pleasure*; a greater or less quantity of contraction, if it be perceived at all, produces *pain*. These constitute *sensation*.

6. A certain quantity of sensation produces *desire* or *aversion*. These constitute *volition*.

7. All animal motions which have occurred at the same time or in immediate succession, become so connected, that when one of them is reproduced, others have a tendency to accompany or succeed it. When fibrous contractions succeed or accompany other fibrous contractions, the connection is termed *association*; when fibrous contractions succeed sensorial motions, the connection is termed *causation*; when fibrous and sensorial motions reciprocally introduce each other, it is termed *catenation of animal motions*. All these connections are said to be produced by habit; that is, by frequent repetition. These laws of animal causation are, according to our author, evinced by numerous facts, which occur in our daily exertions, and are employed by him to explain the diseases and decay of the animal system.

The four *sensorial powers*, upon which all the actions or motions depend, are thus characterized:

Irritation is an exertion or change of some extreme part of the sensorium, presiding in the muscles or organs of sense, in consequence of the appulses of external bodies.

Sensation, is an exertion or change of the central parts of the sensorium, or the whole of it, beginning in some of those extreme parts of it which reside in the muscles or organs of sense.

Volition is an exertion or change of the central parts of the sensorium, or of the whole of it, terminating in some of those extreme parts of it which reside in the muscles or organs of sense.

Association is an exertion or change of some extreme part of the sensorium, residing in the muscles or organs of sense, in consequence of some antecedent or attendant fibrous contractions.

To these four faculties correspond so many classes of fibrous contractions, named *irritative*, *sensitive*, *voluntary*, and *associate*. But all muscular motions, and all ideas, are originally irritative, and become causable by sensation and volition from habit, i. e. because *pleasure* or *pain*, or *desire* or *aversion*, have accompanied them;

those ideas or muscular motions which have been frequently excited together, ever afterwards have a tendency to accompany each other.

Of these motions the *associate* seem most to have excited Dr Darwin's attention. He divides them into three kinds; *irritative associations*, as when any part of the extracted heart of a frog is irritated by puncture, the whole heart contracts regularly: *sensitive associations*, or the trains or tribes of motions established by pain or pleasure; and the *voluntary associations*, or those produced by volition.

The activity of this power of volition is supposed to form the great difference between man and the brute creation; the means of producing pleasure and avoiding pain given to man by this power being denied to brutes.

Corresponding to these four classes of motions, there are four classes of ideas; *irritative*, preceded by irritation; *sensitive*, preceded by the sensation of pleasure or pain; *voluntary*, preceded by voluntary exertion; and *associate*, preceded by other ideas or muscular motions.

It has been observed in Hudibras, that

> " ——— A rhetorician's rules
> Serve nothing but to name his tools."

So we find that a considerable part of Darwin's works is taken up in establishing the new meaning which he attaches to terms well understood and long adopted.

We cannot enter more fully at present into the opinions of the Zoonomia, but we shall have occasion to notice some of them in the succeeding part of this article.

49
Opinions and arrangement of Bichat.

Bichat's system, which has made so much noise on the continent, is chiefly founded on the division of life into two kinds, *organic* and *animal;* the former of which is common to all organized beings, while the latter, as its name imports, is peculiar to animals. Each of these two kinds of life may be considered as composed of two orders of functions, which succeed each other in an inverse order. The first of these series in *animal life* commences with external objects, and proceeds towards the brain; the second begins in the brain, and is thence propagated to the organs of motion and voice. In the first order of functions, the animal is passive; in the second he is active. External objects act on the body through the medium of the first; by the second, the body reacts on the external objects.

Two kinds of motion take place in *organic life.* In the first the formation of the body is constantly going on; in the second there is a constant decomposition: hence the elements of the body are continually changing, while the organization continues the same. Organic life is accommodated to the continual circulation of matter. The one order of functions assimilates to the nature of the animal, the nutritious particles received into the system; the other rejects what is useless, or is so much altered as to become noxious. The assimilating order of functions consists of digestion, circulation, respiration, and nutrition; all of which processes the matter received into the body must undergo, before it can become a part of the animal substance. When it has for some time constituted a part of the body, it is taken up by absorption, conveyed into the circulation, and thrown out thence, by cutaneous or pulmonary exhalation, or by some other emunctories. Hence, the second order of organic functions, or disassimilating functions, consist of absorption, circulation, exhalation, secretion, and excretion. The *brain* is the centre of *animal life;* the *heart* of *organic life.*

Bichat considers the proper balance of life to be preserved by the proportion which exists between the action of surrounding bodies, and the reaction of the system. This reaction is greatest in youth, hence the principle of life is at that time in excess. It is least in old age, and then the vital principle is defective. The measure of life is therefore the difference which exists between the efforts of external powers to overturn life, and the internal resistance to support it. The excess of the former shows the weakness of life; that of the latter indicates its strength.

The following table exhibits Bichat's distribution of the organs, or, as he calls them, *appareils*, belonging to *animal* and *organic life*, and to *generation*, which is common to both.

I. Organs of Animal Life.

Organs	1. *Locomotive,*	including	1. The bones and their dependances. 2. The muscles and their dependances.
	2. *Vocal,* including the larynx and its dependances.		
	3. *External sensitive,*	including	1. The eye. 2. The ear. 3. The nostrils. 4. The tongue. 5. The skin and its dependances.
	4. *Internal sensitive,*	including	1. The brain and its membranes. 2. The spinal marrow and its membranes.
	5. *Conducting sensation and motion,*	including	1. The cerebral nerves. 2. The nerves of the *ganglia.*

II. Organs.

II. ORGANS OF ORGANIC LIFE.

ORGANS
- 1. *Digestive*. including
  - 1. The mouth.
  - 2. The pharynx and *œsophagus*.
  - 3. The stomach.
  - 4. The small intestines.
  - 5. The large intestines.
  - 6. The *peritonæum* and *epiploon*.
- 2. *Respiratory*. including
  - 1. The *trachea*.
  - 2. The lungs and their membranes.
- 3. *Circulatory*. including
  - 1. The heart and its membranes.
  - 2. The arteries.
  - 3. The veins of the general system.
  - 4. The veins of the abdominal system.
- 4. *Absorbent*, including
  - 1. The absorbent glands.
  - 2. The absorbent vessels.
- 5. *Secretory*, including
  - 1. The lachrymal ducts.
  - 2. The salivary and pancreatic ducts.
  - 3. The biliary and splenic ducts.
  - 4. The urinary passages.

III. ORGANS OF GENERATION.

ORGANS
- 1. *Male*.
- 2. *Female*.
- 3. *Produced by this union*. including
  - 1. The membranes and placenta.
  - 2. The fœtus.

50 Recapitulation.

WE have now taken such a view of the progressive state of physiological science, as we deemed consistent with the nature and extent of this article. It has taught us that the prevailing spirit of every age has had a marked influence on the productions both of art and science that have appeared during that period; and that physiology has always been impressed with the character of the science that was most prevalent at any particular period. While the doctrines of Aristotle prevailed in the schools, physiology never extended beyond the bounds that had been set to it by Galen; and the belief in occult qualities universally prevailed. When a taste for metaphysical speculations began to gain ground, this science was given over to the most abstract subtilities and absurd fictions. When Des Cartes had reformed the principles of the ancient philosophy, the study of the animal economy, like all the other branches of physics, was fettered by the trammels of the Cartesian doctrines. After the genius of philosophers was directed to chemistry, physiology also took a chemical turn, which it quitted only to take a new direction pointed out to it by the taste for mathematics and mechanical philosophy, which prevailed among all the literary at the end of the 17th and beginning of the 18th century; and now that the study of chemistry is become so general, we see that physiologists are for reducing the functions of the animal economy to the analytical and synthetical operations of the laboratory, and converting the living body into a furnace where a constant combustion is going on while life remains.

◆

WE are now to enter on the phenomena of life, and the functions of organized beings; and here we must premise, that in our illustration of these phenomena and functions we shall occasionally refer to every class of living creatures; it being our object rather to give a comparative view of physiology in general, than to confine our remarks to the human economy in particular. Indeed much of the physiology of man has already been given under ANATOMY and MEDICINE; and of that of the inferior animals, we have treated of the physiology of the order *Cete* under CETOLOGY; of that of *Reptiles* under ERPETOLOGY; of that of *Fishes* under ICHTHYOLOGY; of that of *Serpents* under OPHIOLOGY.

CHAP. I. *Of the General Phenomena of Life.*

51 General idea of life.

WHEN we take a general view of the objects of nature, we see that they differ from each other in many important particulars, and we soon find that they may be conveniently divided into two great classes; one capable of growth, nourishment, and reproduction; the other not susceptible of these changes. We perceive that all those substances which are found in the bowels of the earth, and many of those which appear upon its surface, continue for an indefinite time in the same circumstances, until they are acted on by each other, when they undergo certain changes which entirely alter their nature and former properties.

Sulphur, in its natural state, is a solid substance insoluble in water, and possessing little activity when applied to the human skin; but if it be subjected to the action of heat, in contact with atmospheric air, or any other gas containing oxygen, it becomes a fluid, very miscible with water, and of a most corrosive quality, namely sulphuric acid. The hydrogenous gas found in the upper part of mines, would remain for ever uncombined with the oxygenous gas which forms part of the atmosphere in which it floats, were it not subjected to the action of caloric, or electricity in a very concentrated state; but as soon as either of these agents comes in contact with the mechanical mixture of gases, a combination takes place, attended with a tremendous explosion, and the hydrogenous gas disappears.

52 Distinction between organized and inorganic matter.

We find that all the bodies to which we give the name of minerals, possess no power in themselves which can enable them to resist the operation of external agents; each individual of them is composed of a small number of principles, and their texture appears to be made up of independent particles. Every other body in nature, comprehending the almost infinite variety of plants and animals, though under certain circumstances subject to the same changes which take place among minerals, have, when these circumstances do not exist, an innate property by which they are enabled to resist the production of these changes. They do indeed undergo certain alterations, but by these their original habit and essential properties are not changed. From the time that a plant springs from the seed, till it ceases to vegetate, it is perpetually receiving an accession of new matter, and giving out a part of its former composition: but the new matter is assimilated to it, and becomes a part of the plant; the identity of the plant is preserved, though its component parts are perpetually changing. The same in a still higher degree takes place in animals. The individuals of this latter class, comprehending plants and animals, possess peculiar structure, very different from that of the former. Their texture is fibrous, and the fibres arranged and interwoven, so as to form parts called organs, by means of which they carry on certain operations or *functions* necessary for their preservation, or for the reproduction of the species. Hence these have been called *organized* bodies, while the others have been denominated *brute* or *inorganic* matter. See NATURAL *History*, N° 7.

The component principles of organized beings are much more numerous in each individual than those of inorganic matter, though their absolute number in the former class is smaller than in the latter. In order to present, under a compendious point of view, the distinguishing characteristics of these two classes of beings, we shall give the following table.

The phenomena of inorganic matter are,	Mobility, Repose, Aggregation, Cohesion, Gravitation, Condensation, Dilatation, Combination, Dissolution.	Resolvable into	Inertia, Impulsion, Attraction, Affinity.
The phenomena of organized matter, besides those of inorganic matter are,	Impression, Sensation, Perception, Affection, Sympathy, Action, Locomotion, Digestion, Circulation, Respiration, Assimilation, Accretion, Reproduction.	Resolvable into four general forces,	Sensitive, Motive, Assimilative, and Vital resistance.

The properties of inorganic matter are,	Extension, Gravity, Hardness, Elasticity, Fluidity, Impenetrability, Divisibility, Expansibility, Permeability, Figurability.	The variations or degrees of which distinguish	Crystals, Salts, Metals, Stones, Fossils.
The properties of organized matter, besides those of inorganic matter, are,	Regularity, Individuality, Spontaneity, Sensibility, Contractility, Irritability, Expansibility, Corruptibility.	The variations or degrees of which distinguish	Man, Mammalia, Birds, Reptiles, Serpents, Fishes, Mollusca, Crustacea, Insects, Worms, Zoophytes, Plants.

53 Effects of life.

The differences that are found to prevail between organized beings and inorganic matter, have always been attributed to something of a superior nature, called vitality or life. This term life forms one of those simple ideas which it is difficult to define, and as all understand the meaning of the expression, a definition is the less necessary; but if it be required, it cannot be expressed more accurately than in the language of Bichat, who calls life *the sum of those functions which resist death*. In short, life is best described by the effects produced on a body while it resides in it, contrasted with those appearances which take place in the same body when life is no longer present.

54 Resistance to chemical change.

One of the most general effects of the presence of life is, as we have said, the resistance which living beings are by it enabled to oppose to the operation of external agents; and this is most remarkably seen with respect to temperature. Every living being possesses, in a greater or less degree, the power of preserving nearly an uniform temperature, which is always a few degrees greater than that of the medium in which it lives. In plants, this power seems to exist but in a low degree. Some of the lower animals which inhabit the air, particularly insects, possess it much more completely. The great heat generated in a hive of bees is a familiar illustration of this. In birds this property is very remarkable, the heat of their bodies being greater than that of any other species of animals. The heat of fishes, worms, and of most reptiles, very little exceeds the temperature of the medium in which they reside; but when the water in which fishes live is frozen, they are capable of resisting, for a long time, the consequences of the diminished temperature. The power which many animals possess of resisting high degrees of heat without any considerable increase of their own temperature, seems still more remarkable, and probably led to the fable of the salamander, which was supposed able to endure the heat of fire, and even extinguish it, when thrown in for that purpose.

55 Degrees of vitality.

Life seems to pervade almost every part of a living being. In animals, every part, except the cuticle, hair, and nails, exhibits marks of vitality; but it seems to be distributed through those parts in a different manner in the various tribes of organized beings. In plants, and in a few of the inferior animals, as the zoophyta, it seems to exist independently in almost every part. A bud, slip, or sucker, torn from the parent plant, and inserted within the bark of another plant, or placed within the earth, in favourable circumstances, vegetates, increases, and in due time becomes a perfect plant, in all respects similar to the parent stock. If a polypus be cut in pieces, each piece lives and grows, till it becomes itself a complete polypus. If a worm be cut in two, so as to leave one part with the head, and the other with the tail, each part becomes a perfect worm, possessing both head and tail. As we ascend, however, in the scale of beings, we find life less equally and independently diffused. A part cut or torn from the body of most animals quickly loses its vitality; but this is lost sooner in some animals than in others. The head of a turtle or a snake is able to bite many hours or even days, after it is severed from the body; and in the former instance, the animal seems for a long time to experience little inconvenience from its loss. The heart of a frog is seen to move many hours after it is cut out.

56 **Functions of living beings.** The principal effects of the presence of life appear in the exercise of those functions or actions by which living beings preserve their existence, or reproduce their like.

57 **Motion.** One of the most general properties of organized beings is that susceptibility to motion, which is called irritability, which appears essential to life, and is possessed, in a greater or less degree, by every class of organized beings. The motions of plants are sometimes very remarkable, and approach very nearly to those which take place in animals. The stamina of the *cistus helianthemum* are seen to move in various directions when the sun shines on them; the leaves of the *mimosa pudica* (sensitive plant), when touched by the hand, or when irritated by the alighting of an insect on them, immediately contract; the *dionæa muscipula* (Venus's fly-trap), when a fly touches its leaves, closes the thorny fringes with which they are beset, on the presumptuous insect, and crushes it to death; but the motions of the *hedysarum gyrans* are the most remarkable of all those that take place in plants. The leaves of this extraordinary vegetable are seen in constant motion through the greatest part of the day, without the intervention of any apparent external impulse; and even when a branch is cut off and kept in water, the motion of the leaves continues for many hours together. All the plants which grow above the earth, expose their leaves and flowers to the warm sunshine, and when situated in a place which is supplied by light only from one quarter, they gradually direct their branches towards that part by which the light enters. In stormy weather they retract their leaves, and fold up their flowers, and when confined in the dark, their branches retain the position which they had when last exposed to the light.

The motions of many of the lower animals, though sufficiently apparent, are more obscure than those of plants. A muscle or an oyster seems to possess little more motion than is necessary to open and close the valves of its shell, and, no more than plants, has the faculty of conveying itself from place to place. This faculty of locomotion, which in all the higher classes of animals is dependent on the will, will be fully considered in the second chapter.

58 **Digestion.** The function which appears to be most universally diffused in living beings, is digestion, (including nutrition) or that by which the substances intended for their nourishment are assimilated to the nature of the body which they enter. This function varies considerably in the different classes. Plants merely attract water from the earth in which they grow, by means of the fibrous parts of their roots, whence it is conveyed by innumerable capillary vessels throughout the whole plant, in which it appears partly to be decomposed, and partly to remain in the state of water, diluting some of the vegetable principles, and thus forming the juices of the plant. In some of the inferior animals, digestion seems to be almost the only function which they are capable of performing. Thus, many of the zoophytes, as the polypi, appear to be almost entirely composed of a stomach, resembling the finger of a glove, into which the aliment is received, the nutritive part extracted, and the excrementitious part thrown out by the same opening. In most other animals, the alimentary canal has two distinct openings, one for the reception of the food, and the other for the ejection of the excrement.

By some animals the food is swallowed entire, and digestion is performed by a simple solution or trituration in the stomach; while in others the mouth is furnished with teeth, or other hard parts, capable of reducing the aliment to a pulpy state, in order to render its further digestion more easy and expeditious. In most animals, the food having undergone some change in the digestive organs, is taken up from them by certain very minute vessels, and carried to every part of the body; but in some it appears rather to exude through pores in the sides of the alimentary canal.

59 **Circulation.** The function of circulation, by which the fluids are constantly moved through every part of the body, is not so general as either of the former functions. In plants there is no proper circulation; for although there are numerous vessels by which water enters into the substance of the plant, and in which the peculiar juices of the vegetable move, the motions of these fluids are not uniform, and do not tend towards one centre. The same defective circulation appears in many of the inferior animals, as in zoophytes and insects. As we rise, however, to the higher classes, we find a perfect circulation. In these there is always a peculiar organ from which the fluids are conveyed to the rest of the body, and to which they again return in a perpetual round. In some animals this central organ is single, while in others it consists of two similar organs joined together, from one of which the whole of the fluids proceed through one particular organ in a lesser circulation, and thence return to the other part, before they are distributed to the general system.

60 **Respiration.** All organized beings require more or less the presence of atmospheric air for their subsistence, or at least for the due performance of the vital functions. In some, the agency of this fluid is conveyed merely by pores upon the surface; as in plants, in which the leaves absorb the air; and in several of the inferior animals, as insects and worms, over the surface of whose bodies are distributed numerous openings, by which the air enters. In animals of the higher orders there are peculiar organs

called lungs or gills, through which air, or water containing air, enters, and from which its beneficial influence is imparted to the fluids which are circulating through them. In general, these beings exist for a very short time, when deprived of atmospheric air, or when the element in which they live is deprived of oxygen; but in some of the lower classes of animals the absence of oxygen is much less injurious; and there are instances of reptiles in particular having been preserved in a state susceptible of life and motion, while buried for many years in the heart of a tree, or in the middle of a block of stone. Respiration, then, though in general necessary to the continuance of vitality, may, in many tribes of organized beings, be suspended for a considerable time, without the principle of life being entirely destroyed.

61 Reproduction.

A function equally general, and equally indispensible with that of digestion, and one which forms another characteristic of living beings, is the function of regeneration, a function more peculiarly necessary, as all organized beings, though capaple of resisting for a considerable time the operation of external agents, tend ultimately to corruption and decay; and as they cannot, like inorganic matter, be regenerated by a reunion of their component principles, it was necessary that they should possess the capacity of producing, while in existence, a creature similar to themselves, to supply their place in the scale of being.

It has been a very general opinion among naturalists, that all living beings, both plants and animals, originate from seeds or eggs produced by the parent. This, although very generally true, is not a universal fact. Most plants, indeed, with which we are acquainted, appear capable, in their natural state, of producing seeds, which form the embryo of a future plant. But in a great many of them new plants are obtained from buds, slips, or suckers, furnished by the parent. In some animals too, as the polypi, reproduction may be effected by dividing the parent into several pieces; and even the natural generation of these animals is performed by protuberances which grow from the body of the parent, and seem to drop off spontaneously, when capable of an independent existence.

There are two striking differences in the manner by which living beings are generated. In some, two distinct sets of organs are necessary, and by the mutual action of these generation is effected; while in others, as in the instances we have mentioned of the polypus, this act of copulation appears to be unnecessary. Almost all plants possess distinct sexual organs, and in most both male and female organs are situated in the same individual. In these plants the female ovum is impregnated by a very fine powder, which is contained in part of the male organs, and is applied to those of the female. We are fully convinced of the necessity of the vegetable copulation, by observing that the females of those plants which have the sexual organs situated in distinct individuals are not capable of producing fruit, or a least do not produce this in perfection, if they are excluded from the influence of the male; and that an artificial impregnation may be brought about by bringing the male and female organs in contact. Many animals are hermaphrodite; and among these the individuals of some species generate without the assistance of another individual of the same species. This appears to be the case with the bivalve shell-fish. Others again, as snails, and most of the mollusca, which crawl upon the earth, copulate reciprocally, or each individual performs the double office of male and female. In most animals, however, the sexes are distinct, and probably a real hermaphrodite in the superior classes never existed. Another striking difference with respect to generation in animals is the more or less perfect state in which they bring forth their young. A large proportion of animals, among which are the insect tribe, fishes and birds, produce eggs, which are afterwards hatched by the heat of the parent, or by that of the sun. Other classes again, as some of the amphibia, and the whole of the mammalia, carry their young for a certain time within an organ destined for that purpose, from which they are excluded in the state of perfect animals.

62 Sensation.

The last function which we shall here notice, is sensation. This appears to be less general than any which we have hitherto mentioned. It has indeed been supposed by many philosophers and naturalists, that plants possess a degree of sensibility; and this opinion has been lately avowed and strenuously supported by the elegant but enthusiastic author of the Botanic Garden, and the Loves of the Plants. That plants possess a suceptibility of receiving impressions, and in consequence of that of being roused into action by external stimuli, we shall readily admit, and shall hereafter assign to this susceptibility its due importance; but as there is no reason to believe that it ever produces sensation, we must not confound it with the sensibility of animals; nor is the difficulty of explaining some of the functions of vegetables, without resorting to the hypothesis of a vegetable sensorium, a sufficient reason for investing them with this faculty. It has even been doubted whether some of the inferior animals, as the zoophytes, possess this function, as nervous fibres have not yet been detected in their organization. It is probable, that there is a regular gradation in the tribes of organized beings with respect to sensation, as well as the other functions; and though we have not been able to discover all the links of this chain, these will probably, as our knowledge of nature increases, come more into view, and we shall then be able to reconcile many circumstances which we cannot at present comprehend.

With respect to the varieties that take place in the number and degree of the external senses, as possessed by the various classes of animals, we may refer the reader to what has been said on that subject in the first chapter of the comparative part of the article ANATOMY.

63 Duration of life.

The duration of life is exceedingly various. We know that there are animals which live but a few hours, as the insects called *ephemeræ;* and that others, as the *elephant*, the *raven*, and the *pike*, may exist for a century. The term of life allotted to plants is also various; some live only for a year, and are hence called *annual* plants; others exist for two years, and are called *biennial* plants; while a few surpass in longevity any thing with which we are acquainted in animated nature. Thus, the *oak* is said to require 100 years, in order to acquire its full maturity; to retain its perfect vigour for the like term, and to complete at least a third century before it entirely decays. The *chesnut* is a still more remarkable instance of vegetable longevity. The account of the gigantic chesnut on Mount Ætna, given by Brydone and other travellers, which has existed for many centuries, must be familiar to most of our readers. We have hitherto considered life as displayed in the exercise of functions; but it may exist independently of this exercise, or it may lie dormant for a considerable time, till called into action by particular circumstances. Every one knows how long a seed or an egg, when excluded from heat, air, and moisture, will retain the faculty of producing a plant or an animal. The only proof we have, that this faculty still exists, is, that when we place the seed or the egg in circumstances favourable to the developement of the embryo which it contains, the process of generation goes on, till the plant or the animal is excluded. We know also, that after an organized being has commenced the exercise of its functions, this exercise may cease for a time, or at least become almost imperceptible, while yet the vital power shall remain susceptible of reviving its activity at a future period. We then say that the animal or vegetable is in a torpid state. On this part of the history of life we shall not enter at present, but shall defer the consideration of it till we come to treat of sleep and death.

The above is a hasty comparative sketch of the functions, exercised by the various tribes of organized beings. It is sufficient to show, that there is in these beings a vital power which completely distinguishes them from brute or inorganic matter.

64
Cause of life.

A question which naturally arises in every thinking mind is, What is the essence of life, or on what does it depend? Though we profess ourselves unable to answer this question in a satisfactory manner, and believe that all who have hitherto attempted to do so, have failed in their attempts, it may be acceptable to most of our readers to know the opinions of the most respectable writers on this abstruse subject. These, therefore, we shall briefly state.

65
Opinions respecting the vital principle.

These opinions have chiefly rested on the question, whether life be an independent, immaterial principle, or merely a physical or chemical modification of matter. We have already, in the historical view which we have given of the progress of physiology, mentioned some of the more remarkable doctrines respecting the principle of life that have been delivered prior to the 18th century; we shall here, therefore, only mention those which have been maintained since that time.

66
John Hunter.

Mr John Hunter, in his valuable treatise on the blood, supposes the principle of vitality to exist in that fluid, or that the blood has life; and has founded this doctrine chiefly on the following proofs. First, It unites living parts, when it is effused between them. Secondly, It becomes vascular like other living parts; its temperature as it flows from the vessel, is always equal in the most opposite temperature in which the body can bear exposure. Thirdly, It is capable of being acted upon by a stimulus, as is the case when it coagulates. Fourth, Paralytic limbs, though deprived of motion and sensation, are yet nourished and preserved alive by the blood circulating through them.

Mr Hunter's idea of the vitality of the blood is merely the revival of one of the oldest physiological doctrines on record; namely, that delivered to the Israelites by Moses, that in the blood is the life of an animal.

67
Goodwin.

Dr Goodwin, in his work on the connection of life with respiration, is of opinion, that the heart is the great seat of the principle of life in all the more perfect animals; and that the contractions of the heart with the ordinary stimulus is the only mark of the presence of this principle; that when the heart contracts under such circumstances, the body is alive; when not, it is dead. Life he therefore defines to be the faculty of propelling the fluids through the circulatory system. According to him, the external concomitant circumstances which operate upon the body in health are heat and respiration, which excite the vital principle to action; and whenever the functions of an animal are suddenly suspended, and the body puts on the appearance of death, it is always in our power to determine whether it be really dead, by restoring the temperature, and by inflating the lungs with proper air. He is of opinion, with some others, that there are no means of determining the absolute deprivation of the vital principle but by the presence of putrefaction.

It has lately become fashionable to consider life as the consequence of certain chemical changes, which are going on in the body; an opinion which is chiefly supported by Hufeland, Girtanner, and Humboldt.

68
Hufeland.

According to Hufeland, life is a chemico-animal flame, to the production of which oxygen is absolutely necessary, and the vital power is the most general and powerful of all the powers of nature. He considers it as the cause of organization, and as possessing the following properties.

1. It has a greater affinity to some organized bodies than to others; thus, the polypus may be cut in pieces without being divested of it, and a decapitated tortoise or a frog deprived of its heart will live a long time after; whilst to the human body, or a quadruped, it would be instant death. According to this physiologist, it is a general rule, that the stronger the affinity between life and an organized being, the more imperfect is the animal; hence the zoophytes, whose whole organization consists in a mouth, a stomach, and a gut, have a life exceedingly tenacious, and difficult to be destroyed. 2. It is in greater quantity in some organized bodies than in others. In general, cold-blooded animals live longer than those with warm blood. 3. It frees bodies from the chemical laws of inanimate matter, and transfers the component parts of a body from the physical or chemical to the organic or living world. 4. It prevents putrefaction, for no organized body can putrefy unless deprived of life.

69
Humboldt.

Humboldt is of opinion, that the degree of vitality depends upon the reciprocal balance of the chemical affinities of all the elementary parts of which the animal body is composed.

70
Cuvier.

Some physiologists of the present day deny the existence of the vital principle altogether, "The idea of life (says Cuvier), is one of those general and obscure ideas produced in us by observing a certain series of phenomena, possessing mutual relations, and succeeding each other in a constant order. We know not indeed the nature of the link that unites these phenomena, but we are sensible that a connection must exist; and this conviction is sufficient to induce us to give it a name, which the vulgar are apt to regard as the sign of a particular principle, though in fact that name can only indicate the totality of the phenomena which have occasioned its formation."

71
Ferriar.

Dr Ferriar, in his observations concerning the vital principle, thinks, that some direct arguments may be

General Phenomena of Life.

brought against the general supposition of an independent living principle. These arguments he divides into two kinds, viz. refutations of the general proofs offered in support of the vital principle; and instances of the direct influence of the mind and brain over what is termed the independent living principle. The great proofs for the support of a vital principle, are the contraction of muscles separated from the body on the application of stimulants; the performance of the vital and involuntary motions without any exertion or even consciousness of the mind, and the birth of full grown fœtuses destitute of a brain. In all these cases, something is alleged to operate, independently of the mind, in producing muscular motion.

Dr Ferriar, in answer to the first argument drawn from the contraction of separated muscles, affirms, it may be said, 1st, That the power of contraction, in a separate muscle, is lost before putrefaction takes place, i. e. before the destruction of its texture; but if its vitality depended on its texture, this ought not to happen. 2dly, The power of contraction, in a separated muscle, is strongest upon its first separation, and becomes weaker by degrees; therefore, the contracting power seems to have been derived from some source from which it is detached by the excision of the part. 3dly, Irritation of the *medulla oblongata*, or of the nerves supplying particular muscles, occasions stronger contractions than irritation of the muscles themselves; and Dr Whytt furnishes an experiment on a frog, directly proving, that the action of separated muscles depends upon the nervous energy. 4thly, Dr Haller himself is obliged to make on this subject a concession sufficient to destroy his favourite hypothesis of the *vis insita*. 5thly, When a paralytic limb is convulsed by the electric shock, the motion never takes place without the patient's consciousness. In this case there is no distinction between the vital principle, and that exertion which in voluntary motion is always attributed to the mind. See Chap. iii.

In answer to the second argument, in favour of a vital principle, drawn from the performances of the vital and other involuntary motions, Dr Ferriar contents himself with only observing, that, allowing the organs of those motions to be supplied with nervous energy, their motions may be very well accounted for by the stimulus of their contained fluids.

The force of the third argument, drawn from the want of a brain in full-grown fœtuses, is taken off by Dr Whytt, who remarks, that as the heart is sometimes wanting in full-grown fœtuses, the argument would equally prove, that the heart is not necessary for the continuance of circulation, as that the brain is not necessary to the support of the system. Accordingly, fœtuses born without a brain do not, in general, survive birth.

Besides the general supposition of an independent living principle, an inference has been drawn from facts, of a nervous energy independent of the brain. By this term is meant, that condition derived from the brain to different parts of the body, by means of which they become capable of motion. To show, by direct proof, that there is no independent vital principle, Dr Ferriar observes, 1. That it is justly urged by Dr Monro against the doctrine of the *vis insita*, that there is too much design in the actions of different muscles, affected by different *stimuli*, to be the effect of mere mechanism. Thus, when the hand or foot is burnt, or otherwise suddenly injured, the muscles on the part immediately stimulated are not thrown into action, nor the muscles on the side irritated, but their antagonists contract immediately and strongly. Now, if the instantaneous action be in this case chiefly produced by an effort of the mind, the supposition of a distinct vital principle is superfluous: if it be said to be produced by a living power independent of the mind, then there must be a rational power in the body independent of the mind, which is absurd. 2. The state of the vital and involuntary motions is considerably affected by the state of the mind, which equally disproves the existence of a separate vital principle, and proves the dependence of the nervous energy upon the brain. 3. Madness, it is well known, is frequently produced by causes purely mental, and in persons apparently in good health; and, as the patient's sensibility to very powerful stimuli is much diminished in maniacal cases, they afford another proof of the subordination of the nervous energy. 4. It has been observed, that in paralytic cases, motion is frequently destroyed, while sense remains. As the cause of palsy almost always resides in the brain, this fact appears equally inexplicable on the opinion of a distinct living principle, or of a nervous energy, independent of the brain. 5. When nerves are regenerated, after being cut through, sensation and voluntary motion are not always restored to the parts beneath the division: the restoration was never made in Dr Monro's experiments. But, on the supposition of a distinct nervous power, the nerve, after its reunion ought to resume all its offices. 6. Dr Whytt asserts, that when the spinal marrow of a frog is destroyed, after decollation, no contraction can be excited in the limbs, by cutting or tearing the muscles. Such are the facts and arguments which Dr Ferriar brings against the opinion of a distinct living principle; and he thinks, that their investigation appears to lead us back to the brain as the source of sensibility and irritability.

72 Rush.

In the life of Dr John **Brown**, we have given an account of the doctrine, of life being a forced state. This doctrine appears to have been first delivered by Dr Cullen, though he afterwards retracted it. Of late Dr Rush of Philadelphia, in his *Lectures on Animal Life*, has advanced many arguments in favour of this doctrine. He includes, in animal life, three properties as applied to the human body, viz. *motion*, *sensation*, and *thought*; and these, when united, compose perfect life. It may exist without thought or sensation; but neither sensation nor thought can exist without motion. He affirms, that the lowest degree of life exists even in the absence of motion. He first considers animal life as it appears in the waking and sleeping state, in a healthy adult; and afterwards inquires into the modification of its causes in the fœtal, infant, youthful and middle states of life, in certain diseases, in different states of society, and in different animals, and lays down the following propositions:

1. Every part of the human body, the nails and hair excepted, is endued with sensibility or excitability, or with both.

2. The whole body is so formed and connected, that impressions made in the healthy state upon one part excite

General Phenomena of Life.

excite motion, or sensation, or both, in every other part of the body,

3. Life is the effect of certain stimuli acting upon the sensibility and excitability, which are extended in different degrees to every external and internal part of the body; and these stimuli are as necessary to its existence as air is to flame.

He continues to observe, that the action of the brain, the diastole and systole of the heart, the pulsation of the arteries, the contraction of the muscles, the peristaltic motion of the bowels, the absorbing power of the lymphatics, secretion, excretion, hearing, seeing, smelling, taste, and the sense of touch, even *thought* itself, are all the effects of stimuli acting upon the organs of sense and motion.

These have been divided into external and internal.

1. The external are light, sound, colours, air, heat, exercise, and the pleasures of the senses.

2. The internal stimuli are food, drinks, chyle, blood, tension of the glands which contain secreted liquors, and the exercise of the faculties of the mind.

Life, therefore (according to the hypothesis of Rush), even thought itself, is merely a quality residing in the component parts of a material system, dependent upon a peculiar organization, by which it is enabled to act, or in some ways to move on being stimulated or excited. Hence life can never be inherent in a simple uncompounded substance, nor in a particle of animal matter; and if the stimulus be withheld from a living system beyond a given time, all motion, sensation, and thought, must necessarily be extinguished.

73 Vital principle supposed by some to be divisible.

Instead of one vital principle, some physiologists have supposed the existence of several in the same body; and from the phenomena that take place in some organized beings, as the reunion of parts that had been separated, the reproduction of others that have been lost, and the separate existence of the divided parts of some worms and zoophytes, it was formerly the opinion of a celebrated lecturer on anatomy, that the vital principle was really divided. From more considerate and extensive inquiry, however, he is now of opinion, that the irritability on which these phenomena depend, is never the direct or immediate operation of the vital principle, but only the consequence of its operation; and in no case exclusively the consequence, but the consequence likewise of other operations proceeding from a number of different causes: and hence it is that a vital principle may often exist where it cannot operate in a sensible manner, from the want of auxiliaries; and hence it is, likewise, that its effects may often be continued, at least for a while after its departure.

With regard to the portions of plants and polypi that continue to live in a separate state, assume the form of their respective species, and propagate their kind, they will be found, on a close examination, to have been originally complete systems; many of the plants and many of the polypi that were usually considered as simple individuals, not constituting one animated system, but rather a congeries of animated systems,—a congeries, too, which after all is nothing more than a species of society, where animated beings are associated together for mutual protection; such as we see among men in a city; among bees in their cells, which, in point of form, are similar to plants †.

Chap. II. *Of Sensation.*

Of Sensation.

74 Necessity of sensibility to organized beings.

As all living beings are so related to each other, and to the inanimate objects of nature, as to be capable of deriving benefit, or receiving injuries, from the one or from the other; it seems necessary that they should possess the faculty of perceiving the proximity of the beneficial or injurious object, that they may avail themselves of the benefit which it holds out, or avoid the danger which it threatens. Accordingly, we find that all organized beings enjoy in some degree the capacity of *receiving impressions*, which we think is proved by the motions which take place in them when affected by external agents. When a plant expands its flowers to the sun, or turns, as it were, its back to the blast; when it stretches out the fibres of its roots to imbibe the distant moisture, or directs its branches to the only chink by which it can receive the light of day; we think these motions are the consequence of that capacity of *receiving impressions*, or of being roused to action by *stimuli*; we think that this may be conceded, without having recourse to the influence of mind, or even the medium of a nervous system; we do not believe that the grass we crush beneath our feet is sensible of pain, nor do we suppose with the poet, that

> —— " E'en the poor beetle that we tread on
> In mortal sufferance feels a pang as great
> As when a giant dies."——

75 Sensitivity.

but we are of opinion, that even in the lowest tribes there is a degree of that faculty, which in the higher orders of animals we call *sensibility*, and which we shall here, after a lecturer on the animal economy in London, denominate *sensitivity*. This inferior degree of the sensitive faculty we shall suppose to be possessed by plants, zoophytes, and animalcules, or those organized beings in which we can perceive no marks of a nervous system; while we shall confine the term *sensibility* to all other classes of animals.

These faculties we consider as qualities of living *bodies*, while we regard sensation, like perception, as a quality of *mind*. We leave it to the metaphysician to mark the line of distinction between sensibility and sensation, and to show how the one arises from the other. See METAPHYSICS, Part I. chap. 1.

76 Nervous system.

The organs of sensation consist of the brain properly so called, the cerebellum, the medulla oblongata, the spinal marrow, the nerves, and ganglia; together forming what is called the *nervous system*. These parts in the human body have been described under ANATOMY. For an account of these organs in the inferior animals, we must refer to the lectures of Cuvier, vol. ii. or the Comparative Anatomy of Blumenbach.

In respect of *sensibility* the animal is only passive; but when *sensation* is produced, he becomes active, in as much as the organs of the external senses are then brought into action. It is by means of these senses that the animal receives intelligence from without. We shall therefore examine these before we mention the phenomena of sensation in general.

1. *Of Feeling.*

77 Feeling.

The most general of all the senses, and the most widely ly diffused over the body of an animal is that of touch or feeling. Animals that possess scarcely any other sense seem always to have that of *touch*. It is doubtless by this that *polypi*, *actiniæ*, and other water animals, perceive the approach of their prey, or are warned of impending danger, from the agitation of the water that is communicated to their bodies. Indeed so general is this sense, that some physiologists think we may reduce all others to it as a genus; and suppose that *smelling*, *tasting*, *hearing*, and *seeing*, are only species of *feeling*. This reference is not uncommon in ordinary speech, as it is not unusual to talk of *feeling* a *smell*.

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† *Barclay on Muscular Motions*, p. 265.

78 Use. By *touch*, taken in its ordinary limited sense, we perceive the more striking external qualities of bodies, as *figure*, *hardness*, *softness*, *roughness*, *smoothness*, *moisture*, *dryness*, *heat*, *cold*; of all which, except figure, we could scarcely form any idea by the other senses. There is probably no sense that can so well supply the place of others as that of *touch*; and it is particularly acute in those who have lost their sight or hearing. See the article BLIND, especially the Appendix.

79 **Organs.** The organs of touch are the skin and its productions, or rather the nervous papillæ (see ANATOMY, N° 76.) that form so large a part of the true skin. As many animals, however, have the body so enveloped in a scaly, shelly, or hairy covering, as to prevent the actual contact of the body by external objects, there are other organs that seem destined to fulfil this office. In man, the points of the fingers and the lips are the most delicate feeling organs; in many quadrupeds too, the lips seem to possess an exquisite sensibility, and in some, as the *rhinoceros*, the upper lip is lengthened out as if to serve the purpose of a hand. The prolonged snouts of the *tapir*, the *shrew*, the *mole*, and the *hog*, seem to answer the same purpose; and the exquisite sensibility and flexibility of the trunk of the elephant is well known to fit that organ for almost all the purposes to which the human hand can be applied. The tail, in some species of *monkey*, *opposum*, and *ant-eater*, and in some reptiles, seems to possess a high degree of sensibility. In some animals, as the *cat*, the whiskers are employed as organs of *feeling*, as we know that these are erected when the animal is passing through a narrow hole. Several species of fishes have *cirri* and *tentacula*, which they seem to use as fingers in ascertaining the approach of their prey; and in insects, the *antennæ* and the *palpi* are evidently organs of feeling, as are the arms, the tufts, and tentacula of *sea-stars*, *sea-urchins*, *actiniæ*, *medusæ*, and many zoophytes.

80 **Nature of touch.** Most of the actions of external bodies on the surface of the animal body, are merely mechanical, though the sensations which they communicate may often be the effects of a chemical change in some of the feeling organs, and this change can be produced only in consequence of the power of simple pressure, to form or destroy some of the combinations that take place in the animal system. The sensations which appear most evidently to arise from a chemical change in the organs, are those that give notice of a change of temperature. When a body that has a temperature below that of the animal, comes in contact with the surface of this latter, we know that it abstracts from that surface a part of its caloric, as by the contact it gradually acquires the temperature of the animal; unless, indeed, it be so large and so cold as altogether to destroy life. As, however, the resistance which the animal body gives to a too great change of temperature, generally confines this change to the surface of the body; there must be something more than a mechanical or a chemical action, or the sense of feeling must depend chiefly on the vital principle.

81 Universality of feeling. As the sense of feeling, from its general diffusion, may be considered as the most essential of all the senses; its degrees of perfection have considerable influence on the nature of different animals.

Of all *vertebral* animals, man seems to possess this sense in the most perfect degree; but among the *invertebral* animals, the touch seems to improve as the other senses degenerate; and those animals which appear to have no other sense, possess this in so exquisite a degree that they seem to feel even the light.

Dr Darwin thinks it probable, that the animal body is furnished with a distinct set of nerves for the sensation of *heat* and *cold*. We do not see the necessity of this, as we think that this sensation is very naturally reducible to that of *feeling*.

82 Sensibility of the animal body. To this head naturally belongs the consideration of what parts of the human body possess sensibility, and what are insensible. This discussion is curious, and some time ago exercised the ingenuity of two very able physiologists, Haller and Whytt; between whom it gave rise to a long and warm dispute. We cannot pretend to enter into the merits of this controversy, for an account of which we refer our readers to Dr Whytt's *Physiological Essays*, and to the *Principes de Physiologie* of Dumas, tom. ii. part iii. sect. 1. chap. 1.

The general result seems to be, that many parts will appear sensible or insensible, according to the nature of the stimuli applied to them, and that many of those parts which in their natural and healthy state appear insusceptible of pain, are when inflamed or otherwise altered by diseases, highly sensible; and that the brain, which is considered as the centre of all sensation, and the puncture or laceration of which is attended with most distressing symptoms in other parts, is to ordinary stimuli as insensible as the cuticle or the nails. See also on this subject, Bichat "Anatomie Generale," tom. i. p. 161—167.

The principal morbid affections of this sense, are *pain*, *itching*, and *want of feeling*; for an account of which see MEDICINE, N° 77. The functions of the skin, independently of its use as an organ of touch, will be considered in two of our succeeding chapters.

2. *Of Tasting.*

83 Tasting. This sense is the most nearly allied to feeling of any of the other senses, and therefore very properly comes under our consideration after that sense.

84 Organs. The principal organ of taste is the tongue, especially at its upper surface, point, and edges; but it also extends to the lips, the palate, and the *velum pendulum palati*. The tongue is not absolutely necessary to taste, as appears from a case mentioned by Jussieu, of a person, who had only a fleshy tubercle in place of a tongue, and yet possessed the sense sufficiently perfect.

85 Different organs variously affected. The several parts of the organs of taste are not equally sensible to every sapid body; the tongue seems to be more particularly affected by saline and saccharine substances, chiefly, however, at its upper surface; the lips are said to

be most susceptible of the taste of *hellebore*, the palate of *belladonna*, and the gullet of *wormwood*. The *momordica elaterium* is said chiefly to affect the back of the tongue, and *colocynth* its middle.

86 **On what the perfection of taste depends.** The greater or less perfection of this sense depends much on the softness, flexibility, and moistness of these parts. As man seems to possess these qualifications in a more eminent degree than most other animals, so, in the natural unsophisticated state of the tongue, he probably enjoys the benefit of taste much more highly than they. Such is the case with all young children, and with the peasant, whose simple fare appears to be eaten with a much greater relish than all the delicacies of the voluptuary, who must have recourse to various stimuli to enable him to derive gratification from even the daintiest viands (A).

Taste seems to be more exquisite when the sapid body is strongly pressed between the tongue and the palate. Taste is also rendered more acute when the tongue is stimulated by various condiments, as *pepper*, *mustard*, which even, when not taken in such quantity as to be very perceptible themselves, evidently increase the relish of the dishes which they season. Much also depends on the nature and state of the bodies that are applied to the organs of taste. These must, in the first place, be either fluid, or capable of solution in the saliva. They must also possess some saline or acrid quality, to render them capable of acting on the nervous *papillæ*. It was formerly supposed, that saline bodies alone possessed the power of affecting the organs of taste; and it was conceived by Bellini, that the different flavours of saline bodies depended on the figure of their crystalline particles. M. Dumas has taken considerable pains, and has advanced several arguments, to show the absurdity of this hypothesis; and we think has treated it with more seriousness than it deserves. That the different sensations which sapid bodies excite in our organs of taste, depend chiefly on a difference in their chemical nature, must, we think, be allowed, and some have gone so far as to suppose, that the sensation depends on some chemical affinity between the sapid body and the nervous fluid.

87 **Modifications of taste.** The impression which sapid bodies make on the organs of taste is modified by age, sex, temperament, and habit. We know that children are particularly pleased with sweet things, while high seasoned dishes and vinous liquors are more palatable to people of a more advanced age. Women, from various causes, especially during pregnancy, and when labouring under hysteric affections, have often very singular tastes. People of a warm and a mobile constitution are often affected by flavours that are almost insensible to others; and custom will render palatable many substances, which, when first tasted, are rejected with disgust.

88 **Uses of taste.** Besides the gratification afforded to animals by the sense of taste, this is supposed to afford one of the principal means of distinguishing between wholesome and deleterious substances. Indeed, with respect to the inferior animals, this discriminating sense is seldom known to fail, and in this instance, they are superior to man, who is often deceived. There are many poisonous herbs, the fruits or roots of which have a taste not unpleasant, but which cannot be eaten with impunity.

On the morbid affections of taste, see MEDICINE, N° 48.

3. *Of Smelling.*

89 **Smelling.** The sense of smelling, like that of taste, is nearly allied to feeling, and is one of those by which we become acquainted with the mechanical and chemical properties of external bodies. It is caused by volatile particles flying off from odorous bodies, and diffused or dissolved in the atmosphere, in union with which they enter the nostrils and affect the nerves of the smelling organs.

90 **Organs.** It is difficult to ascertain what are the essential organs of smelling. We know that in most animals which breathe through lungs or gills, there is either a nose, or there are certain holes that serve the purpose of nostrils; but in many animals there is nothing similar to these, and yet there is every reason to believe that they possess the sense of smelling in an exquisite degree.

Insects discover their food at a distance. Butterflies seek their females, even when inclosed in boxes; and as they are liable to be deceived by resemblance of colour, it is evident that these insects are guided in many circumstances by the sense of smell. Thus the flesh-fly (*musca vomitoria*) lays its eggs on plants that have a fœtid smell, imagining that it places them on corrupted flesh, and the larvæ which are thus produced perish for want of their necessary food.

As the organ of smell, in all animals which respire air, is situated at the entrance of the organs of respiration, the most probable conjecture that has been proposed respecting its seat in insects, is that of Baster, since revived by several naturalists, who placed it in the mouths of the tracheæ or air tubes. Besides many other reasons that might be stated in support of this opinion, we may observe, that the internal membrane of the tracheæ appears very well calculated to perform this office, being soft and moistened, and that the insects in which the tracheæ enlarge, and form numerous or considerable vesicles, are those which seem to possess the most perfect sense of smelling. Such are all the *scarabæi*, the *bees*, *flies*, &c.

The antennæ, which other anatomists have supposed to be the seat of smelling in insects, do not appear to Cuvier to possess any of the requisites for that organ.

The *mollusca*, which respire air, may also possess this sensation at the entrance of their pulmonary vessels; but it is not necessary to search for a particular organ of this sense in them, as their whole skin appears to resemble a pituitary membrane. It is everywhere soft, fungous, and is always moistened by a great quantity of muscous matter. Finally, it is supplied with numerous nerves, which animate every point of its surface.

(A) It is generally supposed, that the sense of tasting is more acute in some of the inferior animals than in man; an opinion which is founded chiefly on the greater size and number of the *papillæ* of the tongue in those animals. It is scarcely possible to decide this point; but we should conceive, from the infinite variety of substances that are occasionally subjected to the human palate, and from the extreme delicacy of taste displayed by some individuals, that man has the advantage of his brute neighbours in this sense.

The worms and soft zoophytes, and all the polypes, are probably in the same situation. It cannot be doubted but that these animals enjoy the sense of smell. It is chiefly by it that they discover their food, particularly the species that have no eyes. Aristotle remarked, that certain herbs, which have a strong odour, were avoided by *cuttle-fishes* and the *octopus*.

91 Nature of odours little understood.

Of all the substances which affect our organs of sensation, odours are the least understood, though the impressions which they make on the animal body appear to be most powerful and extensive. Some bodies are always odorous, because the whole or a part of their substance, being volatile, it is constantly flying off: others become odorous, only under certain circumstances; as when a body containing a volatile principle in its composition is decomposed by another that has a less affinity for that principle, e. gr. when *muriate of ammonia* is decomposed by quicklime.

Odours seem to be propagated in the air, much in the same manner as one fluid is diffused through another. Their motion is not direct like that of light, nor is it rapid or susceptible of reflection and refraction like light and caloric. The odorous particles of volatile bodies may enter into combination with different substances, by chemical affinity, and thus lose their original properties. In this way the effluvia of putrid meat are destroyed by fresh burnt charcoal, and the noxious exhalations from pestilential apartments are removed by the vapours of nitric or muriatic acid.

These circumstances seem to prove that each smell is occasioned by a particular substance floating in the atmosphere. There are others, however, which appear to indicate that odour is not always produced in this manner.

Several bodies yield a strong smell for a great length of time, without sustaining any sensible loss of substance; such, for example, is musk. Some odours are perceived when no evaporation can be observed, as the smell which arises from the friction of copper, that produced by the fusion of a great number of bodies, and even by the melting of common ice. In other cases, real evaporations produce no sensible odour; this may be remarked on the disengagement of several gases, and even on the ordinary evaporation of water. Perhaps these phenomena prove only that the force of sensation is not proportional to the quantity of the substance by which it is excited, but that it depends on the nature and degree of the affinity of that substance with the nervous fluid *. The action of the greater part of odorous substances on the nervous system, is rendered manifest by a number of other effects besides the sensation of smell; some produce faintings, others giddiness, or even convulsions. Some, on the contrary, serve to remove these disorders: indeed the greater part of medicines act in general rather by their volatile and odorous parts, than by their other principles; and afford new proofs of the influence exercised in the animal economy by the gaseous and impalpable substances, the greater part of which are doubtless still unknown to us.

We know not whether odours have a peculiar vehicle, besides the matter of heat, which is common to them all in their quality of vapours or elastic fluids. We cannot explain why odours are agreeable or disagreeable to us, nor why those that are disgusting to us appear pleasing to other animals, and *vice versa*. Though man and other animals are generally pleased with the odour of those substances which serve them as food; yet when their appetite is satisfied, this odour often becomes displeasing to them. On the contrary, some animals appear to have a passionate fondness for strong smelling substances which seem altogether useless to them. Thus cats are extremely fond of *cat-mint*, and the fresh roots of valerian. In general, those odours which are most disagreeable indicate that the substances from which they proceed are injurious. Thus venomous plants, putrid flesh, and poisonous minerals, have commonly an unpleasant odour. This rule, however, is not universal; and the sense of smell, like that of taste, is not an unerring guide to man, whatever it may be to other animals.

It appears that the effluvia of odorous bodies are capable of diffusing themselves through water as well as air; for when these substances are thrown into water as bait for fish, we find that these animals are attracted by the smell from a considerable distance.

92 Comparative physiology of smelling.

The comparative physiology of this sense is very curious, though we cannot explain the reason of the differences that we find to take place in the various tribes of animals. Man in a state of civilized society, where he may have recourse to a great variety of means by which to distinguish the properties of bodies, has less occasion for acuteness of smell; but we know that savages are in that respect greatly his superiors. Their smell is so acute, that like a blood-hound, they can scent their enemy to a great distance, and pursue his track with almost certain success. Among birds and beasts of prey we also find that acuteness of smell is a very general property. Hyænas, wolves, vultures, and ravens, can distinguish the putrid carcases on which they feed many miles off; and it is asserted by naturalists, that jackalls hunt in packs, and follow their game like hounds by the scent. There is a curious diversity in this respect among birds, some having this sense very acute, others very blunt. We are told by Gattoni *, that the cock is scarcely affected with the smell of ammonia or hartshorn, while the duck is said to avoid all powerful odours whether agreeable or otherwise. We are not sufficiently acquainted with the nature of the olfactory membrane, nor with that of the nerves distributed to it, to enable us to form an opinion respecting the degree and the kind of sensations they procure to different animals. It may, however, be at first sight presumed, that all things in other respects being equal, the animals in which the olfactory membrane is most extensive, enjoy the sensation of smell most exquisitely; and experience confirms this conjecture. It would be curious to learn why the animals which possess the sense of smell in the highest degree, are precisely those which feed on the most fetid substances, as we observe in *dogs* which eat carrion.

Of Hearing.

93 Hearing.

The sense of *hearing* is more important than any which we have yet noticed, but it appears to be less generally diffused.

By means of it we become acquainted with those properties of bodies which fit them for making sensible impressions on the air, as hardness, elasticity, &c.; and these impressions on the air, when communicated to the organs of hearing, convey to our mind the ideas of sound.

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* Cuvier.

* *Scarpa de Auditu et Olfactu.*

By this sense we derive two of the highest gratifications that we are capable of enjoying, viz. the pleasures of conversation and of music; and in this way most animals hold intercourse with each other.

94 Organs. The organs of hearing differ exceedingly in the various classes of animals. The *human* ear and its appendages have been described in ANATOMY, Part I. chap. vi. sect. 4.; and for an account of these organs in other animals, we must refer to *Cuvier's Lectures*, vol. ii. or the *Comparative Anatomy* of Blumenbach, chap. xx. Red-blooded animals without exception have evident auditory organs; and analogous parts are found in many of the white-blooded. In a great number of the inferior classes, however, no such parts have been ascertained, though it is certain that many of them do really hear. In all those in which these organs have been detected, there is always found a *gelatinous pulp*, covered with a fine, elastic membrane, and in this *pulp* the ramifications of the auditory nerve are lost. It is therefore, highly probable that the *seat* of hearing resides in the minute nervous fibres that are distributed through the pulp, and that this latter is the medium by which sounds are communicated from the percussed air. We may form a tolerably just idea of the manner in which this pulpy substance is connected with the external movements that are the cause of sound; for this quivering jelly will readily receive the concussions of the air or water that are transmitted to it from the vibrations of sonorous bodies, and communicate them to the nervous filaments. Thus far only can we trace the motion of sound; but the steps by which this motion is carried on till the perception of sound is produced in the mind, are equally unknown to the anatomist and the metaphysician.

95 Varieties of sound. The philosophy of sound has already been treated of under ACOUSTICS. It is necessary here to remark only, that the qualities of sound may be distinguished into *force*, depending on the extent of the vibrations of the body from which the sound proceeds; *tone*, depending on the velocity of the vibrations; *resonance*, arising from the intimate composition of the sonorous body; *simple modulation of voice*, and *articulations*.

96 Comparative physiology of hearing. The human ear can distinguish all these different qualities with relation to one sound; this distinction is made with wonderful accuracy, by persons who frequently exercise that faculty, and particularly by professional musicians. The other mammalia exhibit proofs that they are capable of distinguishing the qualities of sound which relate to speech, that is to say, *simple vocal modulations* and *articulations*: for we may observe daily, that they remember the sound and signification of several words. Some are strongly affected by certain sounds. Acute tones produce a painful sensation in *dogs*, and we also observe that these animals are terrified by violent noises; they therefore distinguish these two properties. Birds have a feeling, no less exquisite, of *voice*, *tone*, *articulation*, and even *resonance*, since they learn to sing with great correctness; and when their vocal organs permit them, can completely counterfeit the human speech, with all the modifications practized by the individuals they imitate.

As to cold-blooded animals, it is well known that several of them call each other by certain sounds, and that others, which are incapable of producing sounds, can at least understand them, as *carps*, which appear when the noise of a bell indicates to them that they are to be fed, &c.; but we know not what qualities of sound they distinguish, and how far, in this respect, the delicacy of their sense of hearing extends *.

For the morbid affections of hearing, see MEDICINE N° 80.

5. *Of Seeing.*

97 Seeing. As we ascend from the simpler to the more complex senses, we find a greater scope for description and observation; but we also find our physiological difficulties increased. The sense of touch, being the most simple of all the senses, requires but a simple organization, and is the most widely diffused; that of vision, on the other hand, is the most complex, and requires for its mechanism, a more elaborate set of organs. There is not, in the whole animal structure, a more curious and admirable organ than the eye, whether we contemplate it in its most perfect state in the human body, or in its most simple conformation, as it appears in the horn of a snail.

98 Organs. The anatomy of the human eye has been sufficiently described in the article ANATOMY, Part I. chap. vi. sect. 5.; and if our readers desire a fuller account of this organ, we may refer them to the elegant work of Professor Soemmering. The structure of the eye in the inferior animals is well described in Cuvier's twelfth lecture, and in Blumenbach's Comparative Anatomy, chap. xvi. We shall extract from the former a description of the eyes of insects and crustaceous animals, as being among the most curious and least known subjects of comparative anatomy.

"The structure of the eye of insects is so very different from that of other animals, even the mollusca, that it would be difficult to believe it an organ of sight, had not experiments, purposely made, demonstrated its use. If we cut out, or cover with opaque matter, the eye of the *dragon fly*, it will strike against walls in its flight. If we cover the compound eyes of the *wasp*, it ascends perpendicularly in the air, until it completely disappears; if we cover its simple eyes only, it will not attempt to fly, but will remain perfectly immoveable.

"The surface of a compound eye, when viewed by the microscope, exhibits an innumerable multitude of hexagonal facets, slightly convex, and separated from one another by small furrows, which frequently contain fine hairs, more or less long.

"These facets form altogether a hard and elastic membrane, which, when freed of the substances that adhere to it posteriorly, is very transparent.

"Each of these small surfaces may be considered either as a cornea, or a crystalline; for it is convex externally, and concave internally, but thicker in the middle than at the edges, it is also the only transparent part in this singular eye.

"Immediately behind this transparent membrane there is an opaque substance, which varies greatly as to colour in different species, and which sometimes forms, even in the same eye, spots or bands of different colours. Its consistence is the same as that of the pigment of the *choroides*; it entirely covers the posterior part of the transparent facets, without leaving any aperture for the passage of the light.

"Behind this pigment we find some very short white filaments, in the form of hexagonal prisms, situated close to each other, like the stones of a pavement, and precisely equal in number to the facets of the cornea; each penetrates into the hollow part of one of these facets, and is separated from it only by the pigment mentioned above. If these filaments are nervous, as in my opinion they appear to be, we may consider each as the retina of the surface behind which it is placed: but it will always remain to be explained, how the light can act on this retina, through a coat of opaque pigment.

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* *Cuvier Comp. Anat.* vol. ii. sect. 13.

"This multitude of filaments, perpendicular to the cornea, have behind them a membrane which serves them all as a base, and which is consequently nearly parallel to the cornea; this membrane is very fine, and of a blackish colour, which is not caused by a pigment, but extends to its most intimate texture; we observe in it very fine whitish lines, which are tracheæ, and will produce still finer branches, that penetrate between the hexagonal filaments, as far as the cornea. By analogy, we may name this membrane the *choroides*.

"A thin expansion of the optic nerve is applied to the posterior part of the choroides. This is a real nervous membrane, perfectly similar to the retina of red-blooded animals; it appears that the white filaments, which form the particular retinæ of the different ocular surfaces, are productions of this general retina, which perforates the membrane I have named choroides, by a multitude of small and almost imperceptible holes.

"To obtain a distinct view of all these parts, it is necessary to cut off the head of an insect that has the eyes large, and dissect it posteriorly; each part will then be removed in an order the reverse of that in which I have described them.

"In the cray fishes, in general, the eye is situated on a moveable tubercle. The extremity, which is rounded on every side, and sometimes elongated into a cone, when viewed by a glass, presents the same surfaces as the eyes of insects. When we cut this tubercle longitudinally, we observe that the optic nerve passes through it in a cylindrical canal, which occupies the place of its axis. Arrived at the centre of the concavity of the eye, it forms a small button, which detaches very fine filaments in every direction; at a certain distance these filaments meet the choroides, which is nearly concentrical with the cornea, and covers the spherical brush of the extremity of the nerve, like a hood. All the distance between the choroides and the cornea is occupied, as in insects, by white filaments, closely arranged in a perpendicular direction to each other, and which have the extremity next the cornea also coated with a black pigment.

"These filaments perforate the choroides, and are continuations of those produced by the button, which terminates the optic nerve."

Cuvier's Lectures, vol. ii.

99
Immediate seat of vision probably the retina.

The immediate seat of vision is still in dispute; but it appears to be the expansion of the optic nerve upon the inner coat of the eye. The other parts of that organ serve to collect, refract, absorb, and sometimes even reflect, the rays of light, according as these operations are required for the distinct vision of any particular animal. Those animals that seek for their prey during night, have a pupil that is very dilatable, and have very little of that dark substance called *pigmentum nigrum*, that lies between the retina and the choroid coat in diurnal animals. Thus, the former have their eyes better adapted to receive and to retain the feeble rays of light, and thus possess a great advantage over the animals which they pursue, whose eyes are calculated for seeing best in a strong light.

The subject of vision has been so fully considered under OPTICS, Part I. sect. 5. that it is unnecessary for us to give any detailed account of it here. We shall therefore merely enumerate the principal phenomena.

100
Phenomena of vision.

1. The rays of light proceeding from luminous bodies, are collected by the cornea; variously refracted by the aqueous, crystalline, and vitreous humours, till they meet in a point (in perfect vision) in the retina, from which the sensation conveyed to the brain, excites there the ideas of light, colour, and other qualities of extreme objects, of which the eye is capable of judging.

2. The image of the object thus pictured on the retina, is inverted, though the mind is habituated to perceive it as if it were erect.

3. There is a certain point within the eye where the retina is deficient, and here the luminous rays make no impression.

4. The eye is calculated to see objects most distinctly at certain distances or foci, though these distances vary considerably in different species, and different individuals. A person of ordinary sight can read a middle-sized print most distinctly at the distance of about eight inches. Those who require a less distance are near-sighted, or *myopes*, and in them the point of divergence of rays is before the retina. Those who require a greater distance are long-sighted, or *presbyopes*; and in these the point of divergence is behind the retina.

5. In those animals that have two eyes, an image of a luminous object is formed in each, though the mind is accustomed to unite both images into one. In strabismus or squinting, the two eyes not being similarly directed, do not concur in producing a single object.

6. Though the images of many objects are impressed on the retina at the same time, the mind can attend distinctly to only one of them.

7. In perfect vision, the pupil contracts or dilates according to the greater or less quantity of light that is present.

8. When the eye has looked steadily for some time on a circumscribed space, of a particular colour, as a piece of red paper placed on a white ground, it perceives a border of a different colour surrounding the original spot. This surrounding colour is called the *accidental* colour of the former, and differs according to the colour of the original spot. In the present instance it is green, or bluish-green. The other natural colours are attended by the following accidental colours, viz. ORANGE, by *blue*, with nearly an equal proportion of *indigo*; YELLOW by *indigo*, with a mixture of *violet*; GREEN by *violet*, with a mixture of *red*; BLUE by *red*, with a mixture of *orange*; INDIGO by *yellow*, with a considerable mixture of *orange*; and VIOLET by *green*, with a considerable mixture of *blue* (B).

(B) Dr Darwin, in his *Zoonomia*, vol. i. sect. 2. employs the phenomena of accidental colours to prove that the

101 Requisites for distinct vision.

The exercise of distinct vision depends chiefly on the following circumstances: 1. The perfect transparency of the cornea, and the several humours of the eye; 2. on the just proportional distance between the cornea and the crystalline lens, and on their degree of convexity; 3. on the sensibility of the retina; 4. on the degree of illumination of the visible object; 5. on the colour of the pigmentum between the choroid and the retina; and, 6. on the contraction and dilatation of the pupil.

102 Action of light on the system.

The action of light on living beings is not confined to its effects in producing vision. It seems to act on the system in general as a moderate but constant stimulus. When the light of day is vivid, as in bright sunshine, the body is more active, and the mind more vigorous, than under a cloudy sky. Those climates which are frequently obscured by clouds and vapours, are notoriously the birthplaces of seriousness and gloom; and Bœotian dulness and English melancholy have long become proverbial; while on the contrary, the serene brightness of an eastern sky has been considered as peculiarly favourable to the exertions of imagination, and the flights of fancy. Mr Stuart, a famous pedestrian traveller, told Dr Rush, that during a summer which he passed in a high northern latitude, where the sun is visible for several months together, he enjoyed an uncommon share of health and spirits, which he attributed to the long continuance of the light of the sun. In a state of nature most animals retire to rest when the light fails, and few people can sleep soundly, unless light be excluded.

The stimulating effects of light are peculiarly evident on persons whose nervous system is unusually sensible; they cannot bear strong light, which not only hurts their eyes, but produces considerable agitation on their whole frame. The same effects are produced on those who have been confined in a dark prison. The countenance of these unfortunates is pale and sallow. This latter effect of the absence of light is similar to what takes place in vegetables, as we know that the colour, taste, and smell of plants depend on their being exposed to a due degree of light.

103 Absence of light supposed to favour obesity.

It has been remarked, that those animals which have been long confined in a dark situation, are universally disposed to grow fat; and this has been found to take place even in condemned criminals, in whom we would least expect it. This obesity has been attributed chiefly to the absence of light. We are disposed to think that the absence of this stimulus can have no immediate effect, but that the disposition to obesity depends rather on the indolence of the confined animals, which is favoured by the absence of light.

For an account of the principal morbid affections of vision, see MEDICINE, No 81.

6. *Is there in some animals a sixth sense?*

104 Bats supposed to have a sixth sense.

From the experiments of Jurin and Spallanzani on the flight of bats that have been deprived of sight, (see MAMMALIA, N° 38.) it has been supposed by some that the accuracy with which these animals in their flight avoided the obstacles that were placed in their way, is owing to some additional sense which they possess. Others have conceived that the sense of hearing, which appears to be very acute in the species on which these experiments were made, is sufficient to supply their want of sight. It is scarcely possible to ascertain which of these two opinions is the more probable; but the writer of this article is rather inclined to adopt the latter, from having observed that when he was walking in an unfrequented street, when it was very dark, he was enabled to avoid running against the common stairs that projected into the street, from a certain sensation that he perceived, when he approached the wall of the stair, which he cannot better describe than by saying that the air at these points appeared to be unusually still.

With respect to sensation in general, we may lay down the following laws, which are considered by Dumas as fundamental principles of this function.

105 Laws of sensation.

1. As activity is an essential character of sensation, this cannot exist without a certain action of the organs, and must be proportioned to the degree of attention bestowed on the external objects, or ideas by which it is produced.

2. A repetition of the same sensations tends to render the sensibility less acute, and less capable of receiving new impressions. By repose its energy is restored.

3. As sensibility cannot be employed on two impressions at the same time, it must hold a certain balance throughout all the organs, and it cannot be acutely excited in one part, without being proportionably diminished in another.

4. Sensibility is a relative faculty, which is not equally obedient to all kinds of excitations, but only to those which have some relation to it in the different parts of the living body.

5. It is increased and accumulated in the direct proportion to the defect or weakness of stimulus.

6. It is not proportioned to the number, arrangement, or distribution of the nerves, and its changes of increase or diminution are not susceptible of calculation.

7. It is inconstant, variable in its progress, and unconfinable.*

To these we may add the following facts respecting this function and its organs.

1. The nerves which are principally distributed to the organs of the external senses, arise from that part of the sensorium that is within the head.

2. The sensations produced in any part by the contact of external bodies, are more perfect, according as the nerves which terminate in that part arise more immediately from the common sensorium.

3. When a ligature is fastened on a nerve, the parts on which the nerve is distributed are deprived of sensation as far as depends on that nerve.

4. Compression of the brain diminishes general sensation in proportion to its intensity. Slight compression produces numbness.

5. Though sensation probably takes place only in the central parts of the sensorium, it is commonly referred to the extremities of the nerves. Thus, a gouty person who has lost his leg, will suppose that he sometimes

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* Dumas, *Principes de Physiologie*, tom. ii. p. 151.

fibres of the retina are thrown into contraction, like those of muscles, and that some of them act as antagonists to others; as he considers the accidental as the reverse of the natural colours.

feels the pain of the gout in the toe of the amputated limb.

6. A sympathy takes place between those parts which are supplied by branches of the same nerve. Thus, a violent scratching of the head often produces sneezing; powerful odours snuffed at the nose produce a flow of tears; the head sympathises with the stomach; the mammæ with the uterus, &c.

These are all the phenomena respecting sensation which we can at present notice; we shall mention others when we come to consider the relation between this function and those of motion, digestion, circulation, &c.

106 Internal senses belong to metaphysics.

What have been called the internal senses, as memory, imagination, and judgment, are rather qualities of the mind, than operations of the brain; and the consideration of them belongs rather to metaphysics than physiology. To that article, therefore, we refer the reader; and we shall conclude this account of the phenomena of sensation with the following comparative view of that function in the inferior animals.

107 Comparative physiology of sensation.

In all animals that have nerves, voluntary motions and direct sensations take place by the same means as in man. The differences in their motions depend partly on the intrinsic mobility of their fibres, and partly on the disposition of their muscles, and the parts to which they are attached.

The differences in their sensations depend on the number of their senses, and the perfection of the organs belonging to each sense. The animals that approach nearest to man have their senses equal in number to his. In certain species, some of these senses are even more perfect in the structure of their organs, and susceptible of more lively and delicate impressions than ours; on the contrary, in proportion as animals are removed from us, the number of their senses and the perfection of certain organs are diminished; but perhaps some animals, at the same time, possess senses of which we can form no idea.

We know not whether there are differences in the intrinsic sensibility of the nervous system of different animals, i. e. whether an equal impression made on an organ equally perfect, would affect every animal with the same force.

The animals next in order to man have, like him, spontaneous, or what we call internal, sensations. Images are excited in them at times, when they receive no immediate impression from external objects. Thus, dogs and parrots dream. We are not certain, indeed, that the more inferior animals experience similar sensations.

The passions produce effects in animals similar to those which they excite in man. Love is manifested in the same manner in all classes; fear occasions a discharge of excrements in quadrupeds and birds; it makes them tremble, and even renders insects immoveable; but the other animals afford fewer examples of these kind of phenomena than man, because they are not masters of their imagination, cannot direct it towards certain objects, and create for themselves factitious passions. We are even ignorant whether their imaginations can, like ours, be wrought up to such a pitch as to make them experience emotions of anger, desire, or fear, from simple ideas or simple recollections; and whether the real presence of the objects which cause these passions, is not always necessary to excite them in the inferior animals; we know, however, that those which approach nearest to us, the mammalia and the birds, have their sorrows. The affliction they feel on the absence or loss of a companion, friend, or benefactor, is manifested by evident signs, in the same manner as they testify their attachment without any temporary inducement.

The same animals exhibit frequent proofs of a very perfect memory; some even appear to possess a certain degree of judgment. But does any thing similar exist in the inferior classes, and particularly in the lowest? Of this we shall probably remain always ignorant.

With so much resemblance in the structure of the nervous system, in its mode of action, and in the number and structure of the principal external organs, why is there so vast a difference, as to the total result, between man and the most perfect animal?

Is this owing to a more accurate proportion in the relative perfection of the external organs, so that one does not so much surpass another? Or has the internal organ, in which are performed all the intermediate operations between the sensation received and the movement executed, that is to say, the organ of perception, memory and judgment, greater differences than we have yet observed? Or, finally, is the substance by which these processes are effected of a different nature? These, however, are not anatomical questions.

The sympathies or effects resulting from the connections of nerves with each other, and the influence of the nerves on vegetative functions, are subject to the same laws in man and the other animals *.

108 Theory of sensation.

The theory of sensation is perhaps more imperfect than that of any other function. On this subject we can derive little light from the structure of the brain and nerves, accurately as this has been examined. Anatomy has taught us, that the principal part of these organs consists of very delicate fibres, intermixed with a medullary pulp, and incased in membranes; and that they are furnished with a great proportion of blood-vessels; but whether the seat of sensation resides in the fibrous or medullary part, we cannot ascertain.

109 Vibration.

It was formerly the opinion, that the nervous power was propagated between the brain and the external organs, by vibrations of the nerves; but as the structure of these chords, and their connection with surrounding parts, must wholly disqualify them for such vibrations, this theory has long been abandoned.

110 Nervous fluid.

Another hypothesis that has been very generally received is, that the nervous fibres are the conductors of a very subtile fluid, called the nervous fluid, the motions of which are the cause of sensation. This was the opinion of Dr Haller, (*First Lines*, chap. x.) and was strenuously maintained by Dr Cullen. We shall present our readers with the following modification of it, as given by an able disciple of Cullen.

"It is probable, (says this writer), that in each nervous fibril, an elastic fluid is inherent, forming, from the moment of animation, a part of it; differing, however, according to the state of the constitution, in power, mobility, and, perhaps, in other qualities. Of this fluid the the nerves are conductors, and are surrounded in their course by non-conducting membranes, while the same membrane lines every part of the brain, and is carried into the deepest cavities, guarding with particular attention the slightest aperture. In this view sanguiferous vessels are chiefly useful in nourishing this medullary substance, and they appear to be necessary also in adapting the nerves to their office; for, when the circulation is greatly increased, the sensibility is more acute; and when it languishes, or is destroyed, the nervous energy soon shares the same fate.

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* Cuvier's *Lectures*, vol. ii.

"This fluid must necessarily be an elastic one; and impressions are apparently conveyed through it by vibrations. It does not follow from hence, that the nerves vibrate like muscular cords; or that, in every the slightest motion, a portion is conveyed from the brain. The elasticity of the fluid is proved from the momentary continuance of the impression after the cause is removed; and vibration is a term employed in many branches of philosophy as a means of communicating motion, without any distinct application. If we touch an object with a stick, or with a metallic rod, we perceive through it the impression, and, in a general way, the nature of the substance. The impression must be conveyed by something; and whatever that something is, it may as well convey impressions through the nerves as through the rod. But through the nerves only can it affect the brain, and produce an *idea*, or some change in the brain, or its fluid connected with the nature of the object, and which conveys to the mind some peculiar and discriminated impression which it afterwards retains [*]."

A third hypothesis, which is at present very fashionable, is, that sensation is produced by a change in the substance of the brain and nerves. M. Cuvier is an advocate for this doctrine, which he illustrates in the following manner.

The nervous system is susceptible of two kinds of action; one which is confined to our sensitive faculty, and another which affects our vital and vegetative functions only. External sensations are produced by the impressions of external bodies, on our senses; internal sensations, by changes which take place, in the state of the internal parts of the body, to which the nerves are distributed; and spontaneous sensations are caused by a change in the nerves, or in the brain itself, without any external excitement.

These circumstances, added to the phenomena arising from the cutting or tying of nerves, show, that sensation does not reside in the external organs, but nearly in the centre of the nervous system, and that the external organs serve only to receive the action of the external bodies, and to convey it to the nerves, by which it is propagated to a greater distance. They also demonstrate, that this propagation is not produced by any matter or concussion, but by a change in the state of the nervous substance. This change may arise from internal causes, or it may be produced by external causes, different from those which usually occasion it. The nerves are not merely passive agents, nor the conductors or reservoirs of any particular matter; but it appears that the substance which produces sensation, is liable to be consumed, or to lose its activity by exertion.

There are phenomena which shew that the general susceptibility of the nerves, for receiving sensations, may vary in consequence of causes external to the nerves themselves, and which can operate only by altering their substance. Certain medicines weaken or revive that susceptibility;—inflammation frequently increases it to an excessive degree. Does this take place in consequence of an increased secretion of the nervous matter? The most remarkable change that occurs in the susceptibility of nerves, is sleep. It is not unnatural to suppose that this change may be occasioned by the temporary loss of the substance which is essentially sensitive. But how does it happen that sleep depends, in a certain degree, on the will? Why do we awake suddenly, or from causes which do not appear calculated to restore that substance? Why does cold produce sleep? From these observations, may it not rather be supposed that this state is the effect of a change in the chemical nature of the nervous substance?

But whether the substance contained in the nerves is exhausted by sensations, or whether it merely undergoes an alteration in its chemical composition, and becomes, as it were, neutralized, it must remain in the nerve throughout the whole of its course, and leave it only at one of its extremities. It does not, however, resemble the blood in the vessels, either as to the manner in which it is retained, or in which it moves in the nerve. There is no evidence of the nerves being tubular. No phenomena indicate that any matter escapes from them when they are divided. Besides, what vessels could have parietes sufficiently compact to retain so subtile a fluid as that of the nerves must be. It is far more probable that it is retained in the nerves, in the same manner as the electric matter is in electric bodies, by communication and insulation; and that the nervous system is its only conductor, while all the other parts of the animal body are, with respect to it, cohibent substances [*].

The theory of *sensorial power*, brought forward by Dr Darwin, has already been noticed.

Chap. III. *Of Irritability.*

III
General phenomena of irritability.

1. When any part of a living animal body that contains muscular fibres, as a part of its composition, is touched with a sharp instrument, with a hot iron, or with a corrosive liquor, or when a shock of electricity or galvanism is made to pass through it, a contraction takes place in the part; and this contraction is discontinued when the stimulus is removed, but is renewed on repeating the application.

2. The same contractions take place in certain parts of a living animal body, from an exertion of the will.

3. Many parts in which the presence of muscular fibres has not been ascertained, possess the same capacity of being excited to motion by stimuli. Such are the ureters, the biliary ducts, the small blood-vessels, and probably the lymphatics; all of which, though not evidently muscular, have a fibrous structure.

4. Some parts of the living animal body which appear rather nervous than muscular, possess a contractile power, as the retina.

5. When the nerves which form a communication between a contractile part and the brain, in the higher orders of animals, are divided or compressed, those parts which before contracted in obedience to the will, lose this power; but,

6. These parts, as well as every muscular part, still contract on the application of stimuli, particularly electricity and galvanism.

7. Such parts of an animal body as have muscular fibres, are thrown into contraction on the application of stimuli, for some time after having been separated from the living body, provided that nervous filaments remain connected with the muscular fibres.

8. It has been found, that the fibrine of the blood is

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[*] *New London Medical Dictionary*, vol. i. p. 398.

[*] *Cuvier's Lectures*, vol. ii.

susceptible of contraction on the application of the galvanic stimulus, after having been separated from the living body.

9. In some animals in which a nervous system has not been detected, as polypes, this contractile power seems to pervade every part of the animal.

10. Plants, in a greater or less degree, possess the power of moving on the application of stimuli; and in some species this motion is very remarkable. See N° 57.

The above are some of the principal phenomena which take place in organized beings with respect to irritability. They are so analogous, that we may attribute them to the same cause or the same vital power. This susceptibility of being thrown into contraction on the application of stimuli is called irritability; and it is possessed in a greater or less degree by every organized being with which we are acquainted.

112 Definition of irritability.

We have restricted the term *irritability* to denote the susceptibility of the fibrous structure to contraction on the application of stimuli; but it is proper to remark that this term has not always been used in the same sense.

113 Different applications of this term.

Irritability has long been employed in medicine, as in common language, in reference to the passions, especially that of anger; and this appears to have been the original meaning of the term.

> *Multo fero ut placem genus irritabile vatum.* Hor.

It is perhaps still more common to apply it to a morbid sensibility of the system; and we speak of a person being of a very irritable habit, or possessing a great degree of irritability, when we mean to say that he possesses a more than ordinary share of sensibility, liable to a more keen sensation of the same impressions.

> "Or are your nerves too irritably strung."
> Armstrong.

Even the accurate Dr Whytt, to whom the proper distinction between irritability and sensibility must have been familiar, and by whom it is in general strictly regarded, sometimes falls into this inaccuracy. He speaks, in his work on nervous diseases, of "a delicate or easily irritable nervous system." In fact, this confusion of irritability with sensibility, appears to be a stumbling block to most physiological writers. We shall presently inquire how far they are independent of each other.

The term irritability, in its most received acceptation, as a property of the muscular fibre, seems to have been first employed by Glisson, about the middle of the 17th century. He distinguishes two kinds of irritability, primary or direct, and secondary or sympathetic[*]. Haller was, however, the first, who treated of irritability, with any degree of accuracy. He confines it to the muscular fibre; though at the same time he will not allow it to many parts, the muscularity of which has never been questioned, and which, since his time, have, by decisive experiments, been proved to possess a considerable degree of contractile power. He completely distinguishes irritability from sensibility, with which he will have it to be totally unconnected; and he attempts to make a distinction between the irritability of the living, and that of the dead fibre[†].

Dr Whytt, whose controversy with Haller respecting the nature of irritability and sensibility is famous in the annals of medical warfare, admits three kinds of irritability: 1. That power of alternate contraction and dilatation which is peculiar to those organs we call muscles; 2. That uniform contraction which takes place in the dartos (one of the coats of the scrotum) and the pores of the skin; and, 3. That redness and inflammation, which is excited in every sensible part of the body, as often as acrid things are applied to it; although this last is allowed by him to be only an effect of the first kind of irritability taking place in the small vessels of the part[‡]. Thus he reduces the three kinds to two, and we may perhaps consider his second kind only as a modification of the first.

Among those who seem to have a sufficiently just idea of the nature of irritability, the word itself is not unfrequently misapplied. Thus, Vicq d'Azyr[||], and Dumas[§], in enumerating the functions of the animal body, called those of motion and sensation, irritability and sensibility. These latter are powers or capacities of living beings, and as such should be distinguished from the functions that depend on them.

In considering the phenomena of irritability, it is necessary to take notice of the several kinds of stimuli which excite it.

114 Stimuli exciting irritability.

These have been reduced by Cuvier to five orders, viz. *volition; external actions* operating on *nerves; external actions* operating on the *fibre* itself; *mixed actions* operating on both the *nerves* and *fibres*, and certain *diseases* or *violent emotions*.

115 Volition.

When the animal body is in a state of health, and awake, the will exercises a prompt and constant influence over the greater part of the muscles, which, on that account, are denominated *voluntary* muscles. A small number of muscles, viz. those which produce the internal movements necessary to life, and which cannot be interrupted, such as the heart and the alimentary canal, are not subject to the will. It must be observed, however, that some of the muscles, that in man and most other animals are involuntary, are subject to the will in others. This is the case with the stomach in ruminating animals, the movements of which may be exerted at pleasure in two different directions. In some muscles, as in those of respiration, there seems to be a mixed action with respect to the will, as this faculty can interrupt their motion for a time, though, in general, this is continued from habit, without the will, or even consciousness of the animal. Those muscles that are absolutely involuntary, are continually excited by an extraneous irritating cause; for the blood which is brought to the heart on every dilatation, determines that organ to contraction, and the alimentary canal is affected in the same manner by its contents. It seems, therefore, that the will is not essential to the action of these muscles, and that it cannot interrupt their motion (c).

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[*] *Glisson de Ventriculo et Intestinis.*

[†] *Haller's First Lines of Physiology*, chap. 11.

[‡] *Whytt's Physiological Essays*, Essay ii. part 1.

[||] *Encyclop. Method. Anatom. Comparée.*

[§] *Principes de Physiologie*, tom. i.

(c) There are facts which shew that the will has often considerable influence even on muscles that are universally styled involuntary. The abbé Fontana, when making experiments with *wheel polypes*, was led to believe that the heart, in these animalcules, is a *voluntary* muscle, and from this belief he learned, in some degree, to accelerate

A muscle laid bare, and exposed to an irritating cause, will contract itself, even in the living subject, without being influenced by the will. It should seem, therefore, that though the muscles which we call voluntary, are usually put in motion by the will, they may yet be excited to action in opposition to that faculty.

116 Nervous energy.

The will itself seems to act only through the medium of the nerves; and it is found that those nerves which supply the voluntary muscles, are generally the largest.

117 External stimuli.

The external stimuli that act on the muscular fibre through the medium of the nerves, and on the fibre itself, are chiefly of a mechanical and chemical nature, as concussions, punctures, lacerations, all of which are capable of producing convulsive motions in all the muscular parts to which the nerves extend.

118 Galvanism.

One of the most remarkable of these stimuli is the galvanic influence. It is well known that the experiments by which this influence is made to act on the muscular fibre, consist in establishing between a muscle and the trunk of the nerves which extend to it, an external communication with one, or a series of substances placed close to each other. Metals are not the only means that may be employed in this operation; and in general, the conductors are not the same as those of electricity. Experiments have sometimes been successfully performed, when an interval was left in the series of excitators: this circumstance, in the opinion of Cuvier, proves the existence of an atmosphere.

The moment the contact takes place, the muscle suffers violent convulsions. These experiments succeed on the living body, or animals recently dead, and even on parts separated from the body, precisely in the manner of those which Haller accounts for on the principle of irritability. Neither pointed instruments nor acrid liquors are necessary; and the galvanic experiments even succeed when these means have failed.

119 Distension.

Distension has been observed to have a powerful effect in exciting irritability.

120 Violent passions.

Violent passions may, to a certain degree, be considered as the acts of the will strongly excited. These, in some cases, have an influence even on the involuntary muscles; for it is no unusual thing for palpitation of the heart, and sometimes even a suspension of its motion, to be the consequence of strong passions. These actions, however, are to be prevented by moderating the excess of sensibility by which they are occasioned. Even in nervous diseases, which appear to be the least connected with those passions whose influence is more immediately felt, the will is often capable of preventing or retarding the approach of nervous symptoms, when the patient is determined to resist the paroxysm.

From what has been said, it appears that, in the superior classes of animals, all the orders of stimuli, either act through the medium of the nerves, or that they are capable of being modified or controuled by the will, the exertion of which depends on nervous influence.

121 Cause of irritability.

With respect to the immediate cause of irritability, there have been several opinions. One of those which has been most generally received is, that irritability is intimately connected with sensibility; or, that it is an immediate effect of the nervous power. This was the opinion of Whytt and Cullen, the former of whom endeavours to prove it by the following arguments.

122 Whytt's arguments in support of nervous influence.

1. We almost always observe the irritability of the muscular organs of the human body to bear a proportion to their sensibility. Thus, children, and people of delicate nerves and very quick feelings, are most subject to convulsive and spasmodic diseases, while on the other hand old people, and those of less delicate sensibility, have a muscular system that is not so irritable.

2. Whatever increases the sensibility of the muscles, also increases their irritability.

3. Whatever lessens or destroys the sensibility of the muscles, also lessens or destroys their irritability or power of motion.

4. That the motions of irritated muscles are owing to the sensation excited by the stimulus applied to them, Dr Whytt thinks highly probable, if it be considered that we are in fact conscious of many involuntary motions in our own bodies, proceeding from a particular sensation, either in the organs moved, or in the neighbouring parts *.

Dr Cullen was so fully convinced of the necessity of nervous influence to produce muscular contraction, that he considered the muscular fibre to be only a continuation of the nervous fibre. See Medicine, N° 73.

123 Haller's opinion of the *vis insita*.

Haller, as we have said, strenuously maintained, that irritability was quite independent of the nerves, and was an inherent power or *vis insita* of the muscular fibre. Indeed there are several circumstances which would induce us to believe that irritability is at least, in some cases, independent of nervous influence. We have seen (N° 111.) that it takes place in those animals in which there is no appearance of nerves; and that it is very remarkable in some species of vegetables, in which none but the most fanciful physiologists have dreamed of finding a nervous system. Nay, it appears that the fibrine of the blood, which we can scarcely suppose to be affected by the nervous power, when taken out of the body, is still susceptible of irritation.

124 General conclusion on this subject.

From a comparison of all these circumstances, we must either conclude, that the irritability of living muscles, and of the superior animals, is different from that of the fibrine, of polypes and plants; or, if we admit that nervous influence is essential to irritability, we must also allow that this influence descends to the latter class of organized bodies.

125 Chemical doctrines of irritability

Before we quit the subject of irritability, we must notice the chemical hypotheses that have been lately proposed, to explain the immediate cause of this faculty.

126 Girtanner's opinions.

The first of these is that of Girtanner, who considered oxygen as the principle of irritability. The arguments

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celerate and retard the motion of his own heart. We have even heard of a person who had such a command over both heart and lungs, that he could, at pleasure, arrest the motion of both, and assume all the appearance of a lifeless corpse. Many of those muscles, which, in ordinary subjects, are not obedient to the will, as those of the *nose* and *external* ear, may, however, become so by habit or patient assiduity in cultivating their action.

* *Physiological Essays*, Essay ii.

arguments on which he founded this opinion are the following.

1. The irritability of organized bodies is always in a direct ratio to the quantity of oxygen they contain.

2. Every thing that augments the quantity of oxygen in organized bodies augments at the same time their irritability.

3. Every thing that diminishes the quantity of oxygen diminishes likewise their irritability.

He distinguishes the organized fibre by three different states:

1. A state of health, or the *tone* of the fibre, in which the oxygen exists in its proper quantity.

2. A state of *accumulation*, in which the fibre is overcharged with the oxygen or irritable principle.

3. A state of *exhaustion*, in which the fibre is more or less deprived of it.

He likewise arranges the substances, that are capable of coming into contact with the irritable fibre, into three classes.

The first comprehends those substances that have the same degree of affinity for the irritable principle or oxygen, as the organized fibre itself; hence the substances produce no effect upon it.

The second comprehends those substances that have a less degree of affinity for oxygen than the organized fibre has: hence these, when they come into contact with it, surcharge it with oxygen, and produce a state of *accumulation*. They are called negative stimuli.

The third comprehends substances for which oxygen has a greater affinity than it has for the organized fibre. These, therefore, deprive the fibre of its oxygen, and produce a state of exhaustion. They are called positive stimuli.

By way of answer to this fanciful doctrine, we may observe, that if oxygen were so essential to irritability as is supposed in Girtanner's positions, those animals which respire most oxygen should possess most irritability, and those which are capable of living for a long time in deoxygenated air, should have their irritability very low. Now, the reverse of this is found to take place. The muscular fibres of birds which respire more oxygen than most other animals, possess but little irritability, while reptiles and worms, which can live for a long time without oxygen, are universally and strongly irritable *.

127 **Hypothesis of Humboldt.**

The other opinion is that of Humboldt, who considers the galvanic fluid as the source of nervous power, and the primary cause of irritability. He lays down three principles as necessary to excite irritability; viz. 1. Oxygen, which forms combinations with different acidifiable bases. 2. The acidifiable bases (carbone, hydrogen, azote, and phosphorus), of the fibre, with which the oxygen may combine. And, 3. The galvanic fluid.

The galvanic fluid produces, according to Humboldt, the same effect in the animal economy, as the electric fluid in the mixture of azote and oxygen. It is this galvanic fluid that, being conveyed by the nerves, brings about the combinations of the oxygen with the different acidifiable bases of the fibres; but when the nerve of a part is tied, it prevents the fluid from passing, which explains the reason of the irritability being destroyed.

The oxygen necessary for these unions is carried by the arterial blood in the course of circulation; and the acidifiable bases, which are to unite with it, are found to be already present in the fibre.

He found that every thing that augments too much the quantity of the acidifiable bases diminishes the irritability; and that every thing that increases too much the quantity of oxygen, likewise diminishes it; and he thinks it very probable, that the same takes place with respect to the proportion of the galvanic fluid.

It is therefore only in a just equilibrium of these principles that the necessary irritability of the parts consists.

Upon these principles this philosopher thus explains the production of muscular motion. "In a state of repose, the nerve being inserted in the muscles, the galvanic fluid is put into equilibrium in organs that touch each other. The spontaneous motion is made by a surcharge of galvanic fluid into the nerve. It appears that the instant we wish to make a motion, the galvanic fluid produced in the brain, is carried *en masse* towards the part that ought to move, and surcharges the nervous fibres. A discharge from the nerve is then made into the muscles. The particles of these last, animated by increased affinities, approach each other, and it is this that constitutes the phenomena of muscular motion *."

128 **Laws of irritability by Dumas.**

Dumas lays down the following fundamental laws respecting animal irritability.

1. The essential characteristic of irritability consists in a series of contractions and dilatations, determined either by the impression of an external stimulus, or by the simple exertion of the will.

2. Irritability is independent of the action of the nerves; and though generally diffused throughout the animal organization, it belongs rather to the muscular fibre than to any other structure. Its action is in proportion to the number of fibres upon which the irritating causes can exert their influence.

3. Irritability is a relative faculty which is not indiscriminately obedient to every species of excitation, but only to those which have some relation to it in the different parts of the living body.

4. There belongs to each organ a specific irritability which requires a peculiar stimulus, accommodated to its nature, and to the kind of functions which it exercises.

5. Irritability has certain vicissitudes of diminution and increase, which vary in the different species of animals, in the different organs of the same animals, and under the different circumstances that successively occur in the life of an individual.

6. Irritability is developed with most energy at the moment of death, and immediately after this has taken place.

7. It is multiplied and revived in proportion as the organ which has lost it is divided into a greater number of pieces.

8. It diffuses itself in each part with a velocity proportioned to the activity, number, and duration, of the irritations by which it is excited.

9. There exist mutual relations with respect to influence between sensibility and irritability, though each of them is essentially distinct from the other.

10. The exercise of this faculty supposes in the organs a moderate degree of cohesion, above or below which the action of this force is enfeebled, obstructed, or opposed *."

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* *Johnson's Animal Chemistry*, vol. iii.

* *Johnson's Animal Chemistry*, vol. iii. p. 24.

* *Principes de Physiologie*, tom. iii. p. 53

Chap. IV. *Of Animal Motion.*

129 Organs of motion. The organs of motion vary considerably in their nature and connection in the different classes of animals. In some tribes, as in the animalcules and polypes, no distinct organs can be observed. In all above these, however, there are evident muscular fibres, and in many there are hard parts or strong membranes, which serve as points of attachment and fulcra of motion to these fibres. The muscular fibres are to be considered as the essential moving organs, while the parts to which they are attached are merely the passive functions of this organ. It would be out of place here to enter on a comparative account of the organs of motion; and there is the less occasion for it, as they have been more or less fully described in the former part of the work. The bones, ligaments, muscles, and tendons, with their appendages, as they appear in man, have been amply described in the first and second chapters of the First Part of Anatomy; and those of other animals have been briefly noticed in the Second Part of that article. Such of our readers as wish for a more particular account, may consult Cuvier's Lectures, vol. i. or Blumenbach's Comparative Anatomy, chap. 1, 2, 3, 4, 5, and 22.

130 Principles of muscular action. Many of the phenomena of muscular motion, as they take place in man, have also been related under Anatomy, N° 85 and 86. We shall here therefore only enumerate and briefly illustrate these phenomena, and shall then proceed to consider a most interesting part of the physiology of motion, the progression of different animals.

Dr Barclay, in his late excellent work on the muscular motions of the human body, has considered the general subject of muscular action under the following heads, which may be considered as fundamental principles.

1. Fleshy fibres that are continued into tendon by a straight line, shorten the muscle which they compose, in the same degree in which they shorten themselves; those fibres which enter the tendon obliquely, shorten it more, and still more in proportion to their degree of contraction, as they deviate more from the line of the tendon, and approach nearer to the perpendicular, in which last direction they would shorten the muscle most with the least contraction.

This may be illustrated in the following manner. Plate ccccxvii. fig. 1. Let AB (fig. 1.) represent a tendon, and CD a fleshy fibre; and let us suppose that AB is the diameter, and CD the radius of the same circle ADB. It is evident that if the fibre CD should contract so as to bring the point C of the tendon to the point G in the straight line, the extremities of the tendon A, B, (which are supposed to be moveable) would come respectively to E and F; and the situation of the tendon itself would be represented by the angle EGF. If the fibre could be supposed to contract so as to bring the point C to D, the two parts of the tendon CA and CB, would come in contact. If, on the other hand, the fibre CH, which enters the tendon obliquely, were to contract to H, so as to bring the point C to H, the point A would be drawn but a little beyond the middle point C, so that although this latter fibre is contracted to as great an extent as the former, it has not brought the extremities of the tendon so near together.

2. When two fibres enter a tendon on opposite sides and contract at the same time, they will draw the tendon in the diagonal; and the more nearly the angles which they form with the tendon approach to right angles, the more will the length of the muscle be shortened in proportion to the degree of contraction of the fibres.

Let the fibres BC, BD, BE, BF, BG, (fig. 2.) be Fig. 2. fleshy fibres, inserted into the tendon AB, at the point B, and let us suppose that all these fibres co-operate in bringing the point B to the point G, in the straight line BG. Now the straight fibre BG will be so much shortened when B comes to G, as to be obliterated, while the oblique fibres EB and FB will be shortened only to E *a* and F *b*, and the more oblique fibres CB and DB will remain of the length of C *c* and D *d*.

3. All muscles that are inserted into bones, are thereby furnished with levers, and as in the action of all levers there are also a fulcrum, a power, and a resistance, these in different cases will be differently situated with respect to one another.

a. In the motions of the head backward and forward on the atlas, the fulcrum is situated between the power and the resistance; or the lever is of what is called in mechanics, the first kind. See Mechanics, N° 33.

b. When the tibia rests upon the astragalus, and the heel is raised by the muscles of the calf of the leg acting on the tendo achillis, the resistance (which in this case is the pressure of the tibia) is situated between the power and the fulcrum, which are here respectively at the heel and at the toes; or the lever is of the second kind.

c. In raising a weight at the palm of the hand, and bending the arm at the joint of the elbow, the power of action in this joint is situated between the resistance and the fulcrum, which are here respectively at the palm of the hand and the *distal* extremity of the humerus (D), or the lever is of the third kind.

The shortness of the lever, and the consequently great force of the muscular power required to overcome the resistance in this last case, may be thus illustrated. Let AB (fig. 3.) represent the radius articulated at B with Fig. 3. the *humerus* BC; let DFE represent the *biceps flexor* muscle running along the *humerus*, and attached to the *radius* at E; and suppose a weight W hung to the distal extremity A of the *radius*. Now, BH will represent the lever of resistance, and BG perpendicular to it the lever of the muscle, which is in this case extremely short.

4. As, other things being equal, all muscles produce a greater extent of motion by a less proportional degree of contraction, and consequently a less proportional change in their fibres, than if they were shorter; those muscles which follow a direct course are seldom attached at the nearest points of the two bones with which

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(D) In Dr Barclay's nomenclature, that extremity of a bone which is towards the trunk is called *proximal*, and that extremity which looks from the trunk is called *distal*.

which they are connected. Hence, beside the advantages already mentioned, relations are thus formed between parts at a distance, and the mutual dependence of the functions and their organs is extended and strengthened. On the contrary, those muscles that are not extended along the surface of the bones to which they are attached, are observed to follow an oblique direction, by which they acquire not only contractibility and length, but at the same time a shorter lever than if they had been inserted at the same place with a less obliquity.

5. Of muscles attached to ribs that are parallel, equally moveable, and at right angles to the vertebral column, those that follow a direct course from one to the other, will act on each by equal levers, and make them approach with the same velocity; while those that observe an oblique course will act on each by different levers, and make them approach with different velocities.

Fig. 4.

Let AB and CD (fig. 4.) represent two parallel ribs, articulated with the vertebral column at A and C, where they are equally moveable; and let DB and DE be two muscles, the former observing a direct, and the latter an oblique course. The levers of DB will be AB and CD, which, as AC is parallel to BD, are evidently equal; but the levers of DE will be CF and AG, which being of different lengths, the muscle must act with different degrees of force on the different ribs, so that it will make CD, on which it acts with the longest lever, approach AB, faster than it will make this latter approach the former.

Corollary.—When bones are not parallel, the muscles that cross in the interval between them, must fall obliquely on both, as it is impossible for a straight line to be at the same time perpendicular to two other lines, unless these be parallel.

6. As all bones move on a centre or axis of motion, while the muscular attachments move in a circumference, the muscles, in changing the relative position of any two bones, must, at the same time, be changing the direction of their own action, and varying their lever.

Fig. 5.

Let AB and CD (fig. 6.) represent parts of two parallel ribs, and let AB be moveable on the centre A, and let CF and GE be two muscles inserted obliquely into AB at F and E. Now suppose that by the action of these muscles, AB is brought into the position A *b*. The points of attachment of the two muscles to AB, will now be *f* and *e*, and the muscles will be C *f* and G *e*, having changed their length, situation, obliquity, and lever.

7. All muscles where the points of attachment move in a circle, draw either towards the centre, or towards the circumference.

8. If any two bones could, by the action of their muscles, be made to approach in a parallel direction, the oblique muscles attached to their parallel and approaching surfaces, would perform a greater extent of motion with a less shortening of their fibres, than any straight muscles attached to the same parallel surfaces.

Fig. 6. & 7.

Let AB and CD (fig. 6. and 7.) be parts of two ribs that are parallel, and that will continue parallel till they are brought in contact by the action of the straight muscles AC, EF, and BD, or by the action of the oblique muscles CE and DE (fig. 7.) and FA and FB (fig. 6.). It is evident, that when the point E comes in contact with F, the length of the straight muscles must be obliterated, while that of the oblique muscles will only be shortened by *c* E and *d* E in fig. 7. and *f* A and *g* B in fig. 6.

9. As, however, no two bones can approach one another in a parallel direction, at least by the action of a single muscle, and as no muscle can continue to act in a direction perpendicular to their two approximating surfaces; a muscle entering them at right angles, when they are parallel, may be placed so near to the centre of motion as to carry the bones through a given space, with a less shortening of fibres than any oblique muscle that has the same origin, but is inserted at a distance, and acts through the medium of a longer lever. Further, a muscle with a less obliquity may be so situated as to carry the bones through a given space, with a less shortening of fibres than any other muscle of the same origin, but of a much greater obliquity.

Fig. 8.

Let AB and CD (fig. 8.) be two ribs, of which AB is moveable about the centre A; and suppose that by the shortening of the straight muscle EF, and of the two oblique muscles, EG and EH, AB is brought into the position A*b*. The points of attachment, after moving in the segments F*f*, G*g*, and H*h*, will now be respectively at *f*, *g*, and *h*. Now, on the centre E, with the radii E*f*, E*g*, and E*h*, describe three different circular segments. The difference between the present and former lengths of the most oblique muscle EH, will be εH, while the differences between the present and former lengths of the muscles EG and EF, will be only ι G and η F respectively.

10. The shortenings which any muscle suffers in carrying round the point of its attachment through a given space, will partly depend on the length of its lever, partly upon its degree of obliquity, partly on its drawing *peripherad* or *centrad*, and partly on its acting without or with a pulley (E).

11. The lever of a muscle, which is varied with every degree of obliquity, is also varied by every change in the centre of motion. Where bones are connected by large surfaces, the centre of motion frequently shifts from one part to another; but in general it approaches towards that aspect whither the bone is moving at the time; and as it advances, the muscles recede, to increase their force.

a. The lever of resistance, as well as of the power, is varied by the several changes of position; is sometimes shortened at the time that the lever of the power is lengthened; and *vice versa.*

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(E) The terms *peripheral* and *central* are employed, by Dr Barclay, to denote the aspects of any organ, according as they respect the *circumference* or the *centre* of the organ; and when the termination of these words is changed from *l* into *d*, they denote, like the other terms of his nomenclature, the direction in which the action of these parts is exerted. See Barclay's Anatomical Nomenclature.

If AB (fig. 9.) represent the radius, BC the humerus, DE the biceps flexor muscle, and R the resistance hung to the distal extremity of the radius, it will be evident that, when BA is, by the action of the flexor muscle, brought into the position B *a*, the lever of resistance will no longer be BA, but BH, equal to a perpendicular straight line drawn from B, the centre of motion, to the plane of resistance; and, as the lever of resistance has been shortened, the lever of the muscle has been proportionably lengthened. Were the radius to resume its former position, the reverse of these circumstances would take place.

b. Sometimes again, the lever of the power and of the resistance are lengthened or shortened at the same time.

Let AB (fig. 10.) represent the tibia, BC the femur, and DEF the crureus muscle; and that the femur, with the weight of the body, is to be raised to the situation B *c*; the centre of motion will, during extension, approach towards the muscle at the rotular aspect, while the plane of resistance, as is evident from the figure, will be approaching to the centre of motion.

c. In the changes of attitude, while a bone is turning on its centre of motion, the centre itself is often at the same time describing, either the segment of a circle, or a line composed of circular segments.

Let AB (fig. 11.) represent the foot, BC the *tibia*, CD the thigh bone, and DE the trunk; and let us suppose that it is required to bring the three last, by the action of their muscles, to the perpendicular BF, so that BC shall occupy the situation of BG, CD the situation of GI, and DE the situation of IF; the point C on the centre B will move in the segment CG, and as C is changing its position in CG, the point D, which moves round the point C as its centre, will, if the extensions be regularly performed in the same time, describe such a curve as DI; for as the point D must necessarily move atlantad and sternad, in order to preserve the centre of gravity, the general direction of its course must be known; and if CG be divided into equal parts, and at each of the divisions a circle described with the radius CD, the points in DI corresponding in number with the points in CG, and at equal distances in the sternal direction, will each be found in the circumference of one of the circles described successively round the point C as it passes along the segment CG.

In like manner, if the extensions of CD and DE be regularly performed in the same time, the point E will describe such a curve as EF, the points in EF being in the circumferences of the several circles successively described round the point D as it moves along the curve DI.

12. When we examine the structure of the animal system, we shall generally find that the motions of the bones, as produced by the muscles, are the combined effects of different forces, and hence that a small number of muscles is enabled to produce, with steadiness and accuracy, an almost infinite variety of changes *.

For more on the general subject of muscular action, and for an account of the principal motions of the human body, we must refer to Dr Barclay's publication.

One of the most interesting enquiries respecting animal motion, is that of the progression of different animals, or of the powers of loco-motion.

131 Progressive motions. Those animals which possess the faculty of changing their place, exercise this faculty by very different organs. Some can only creep, as worms, and many mollusca; others can only swim, as all fishes, many of the mollusca, and some of the testacea. Most birds can both fly, walk, and run, while a few do not possess the power of exercising the first of these motions. All the mammalia, and most reptiles, properly so called, can walk, run, climb, leap, and perform a variety of other motions; and a few of the former class can imitate the flying of birds. We shall briefly examine the mechanism of these different actions, but by way of introduction, we shall first consider how the action of standing is performed.

132 Standing. Standing, in most animals, is solely the effect of the continued action of the extensor muscles of all the joints, as is evident from the circumstance, that if an animal, while standing, suddenly dies, or in consequence of some powerful cause, as a strong electric shock, ceases to make the necessary efforts for preserving the upright position, all the articulations of the legs yield to the weight of the body, and bend under it. In some animals, however, the extension of the muscles is so much assisted by powerful ligaments attached to the articulations of the legs, that they are enabled to continue standing for a much longer time, and with much less fatigue than most others. This is the case with birds that perch, and it is particularly remarkable in the stork, which by means of this peculiar mechanism is able to stand on one foot for several days together.

The action of standing is somewhat different, according as the animal stands on two feet or on four.

133 Standing on two feet. That a body may be supported in a vertical position, it is necessary that it be so disposed as to be in a state of equilibrium, or that it be so balanced that a perpendicular line from the centre of gravity shall fall within its base. See MECHANICS, N° 193, et seq. It is evident that the more extensive the base is on which the body stands, the less is the danger of its losing its balance. Man can very easily preserve himself in the vertical position, from the broad basis formed by his feet, and from the great power he possesses of separating these to a considerable distance. This latter depends chiefly on the greater weight of his pelvis, and the length and obliquity of the neck of the thigh bone, by which this bone is carried more outward, and removed farther in its articulation, than in any other animal. In man, too, the foot is peculiarly adapted to stand firmly on the ground, from the flatness of its inferior surface, and from having the heel bone so formed as to come in perfect contact with the ground. The muscles that move the foot are also very advantageously inserted, and the extensor muscles of the heel are proportionably thicker than in most of the mammalia.

The thigh of man, when in the erect posture, is in a straight line with the trunk and the leg, whereas in quadrupeds, it is situated close upon the flank, and forms an acute angle with the spine. On this account, the thigh bone of quadrupeds is flat, and proportionally weaker than that of man. The extensor muscles of the thigh are proportionally stronger in man than in the other animals; and as the thigh bone moves upon the pelvis in every direction, these extensors are in man so considerable, that he is the only animal that possesses what are properly called hips.

In consequence of this structure, the human sacral extremities are furnished with a sufficient base, and form very

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* Barclay on Muscular Motion. Part ii. chap. 3.

very solid bodies for supporting the trunk. Man also possesses several advantages for maintaining the general equilibrium of the body, especially the facility with which he holds his head in the erect posture, owing to the position of the occipital bone, and the horizontal direction of the eyes and mouth. See the article MAN, N° 5. and 6.

The quadrupeds that sometimes try to stand on their hind feet only in order that they may either employ their fore feet in taking hold of some object, or avoid keeping their head too low, seem rather to sit than to stand. Their trunk rests at the same time on their hind feet, as far as the heel, and on the buttocks; it is still necessary, however, that their head and neck should be proportionally small, as in *monkeys*, *squirrels*, *opossums*, *&c.* otherwise the weight of those parts would be too great for the force employed in their elevation; but even when seated, the animal is generally obliged to rest on the fore feet, as may be observed in *dogs*, *cats*, *&c.*

Some quadrupeds use their tail as a third foot, to enlarge the base of the body: and when it is strong, it is capable of contributing to their support for some time. We find examples of this in the *kangaroos* and *jerboas*.

We have already noticed the mechanism in the feet of birds, which enables these animals to support themselves on two legs, though they do not stand in a vertical position, and though the atlantal part of their bodies is advanced more beyond the centre of gravity than the sacral part. Other advantages possessed by birds in this respect are, the great flection of the thigh bone and tarsus; the length of the anterior toes, and the length and flexibility of the neck.

134 Standing on four feet.

An animal which stands on four feet is supported on a very considerable base; but from the great weight of the head and neck in these animals, their centre of gravity is nearer to the atlantal than to the sacral extremities (F). It is evident from this, that in quadrupeds, the former must sustain almost the whole weight of the body; and we find, accordingly, that they are furnished with very strong muscles. In short, all that the sacral extremities seem to want in muscular force, appears to be transferred to the atlantal.

As in most quadrupeds the head inclines towards the horizon, and the neck is often very long, very powerful means are required to sustain the former. These means are furnished by the great size, and extensive attachments of the muscles of the neck, and especially in many quadrupeds by the cervical ligament. In the *mole*, which employs its head to raise considerable burdens of earth, the cervical muscles are peculiarly strong, and the ligament is converted into bone.

The body of a quadruped hangs between the four legs, and by its weight tends to draw the spine downwards. This is counteracted by the abdominal muscles, especially by the straight muscles, which produce a curvature in the opposite direction. The abdominal muscles act with peculiar force in arching the spine upwards in those mammalia that are covered with scales or spines, and are accustomed to roll themselves up on the approach of danger, as the *hedgehog*, the *armadillos*, and the *pangolins*.

Oviparous quadrupeds or reptiles, have their thighs directed outward, and the inflections of the limbs take place in planes that are perpendicular to the spine. In these, therefore, the weight of the body must act with a much longer lever, in opposing the extension of the knee-joints; and accordingly they have the knees always bent, and the belly dragging on the ground between their legs, whence the name of *reptiles*.

135 Walking.

In walking on a fixed surface, the centre of gravity is alternately moved by one part of the extremities, and sustained by the other, the body never being at any time completely suspended over the ground.

136 Walking on two feet.

Animals which can stand erect on two legs, such as man and birds, walk also on two legs. But several quadrupeds that cannot stand on two feet but with great difficulty, may yet move in that posture for some time with sufficient ease. This arises from its being in general less painful to walk than to stand, the same muscles not being continued so long in action. And also it is less difficult to correct the unsteady motions by contrary and alternate vacillations (a thing easy in walking), than it is to prevent them altogether.

When man intends to walk on even ground, he first advances one foot; his body then rests equally on both legs, the advanced leg making an obtuse angle with the tarsus, and the other an acute one. The ground not yielding to the point of the foot, the heel and the rest of the leg must of necessity be raised, otherwise the heel could not be extended. The pelvis and trunk are consequently thrown upward, forward, and somewhat in a lateral direction. In this manner they move round the fixed foot as a centre, with a radius consisting of a leg belonging to that foot, which, during this operation, continually diminishes the angle formed with the tarsus. The leg which communicated this impulse is then thrown forward, and rests its foot upon the ground; while the other, which now forms an acute angle with its foot, has the heel extended in its turn, and in like manner makes the pelvis and trunk turn round upon the former leg.

As each leg supports the body in its turn, as in standing on one foot, the extensor muscles of the thigh and knee are brought into action, to prevent these articulations from yielding; and the flexors act immediately after, when the leg having thrown the weight of the body on its fellow must be raised before it can again be carried forward. As the undulatory motion that necessarily attends a man's walking, cannot be perfectly regulated on both sides, he cannot walk in a perfect straight line, nor can he walk in a direct course with his eyes shut.

In walking down an inclined plane, or descending a staircase, as the advanced leg is placed lower than that which remains behind, the extensors of the leg must act more powerfully to prevent the body from falling backwards. Again, on ascending such situations it is requisite at each step, not only to transport the body horizontally,

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(F) These terms signify the same as *superior* and *inferior* in man, *anterior* and *posterior* in quadrupeds; but are more convenient, as applying indiscriminately to both. *Atlantal* denotes what is next the *atlas*; *sacral* what is next the *sacrum*. See *Barclay's Nomenclature*.

zontally, as on walking on level ground, but to bear it up against its own weight, by means of the extensors of the knee of the advanced leg, and those of the heel of that which is behind; this is the reason of the knee and calf of the leg being fatigued in ascending; and the fatigue is relieved by inclining the body forward, because then the lever by which its weight acts on the knee is shortened.

Running is only a succession of short leaps, and it will be understood from what we shall presently say of leaping.

137 Walking on four feet.

When a quadruped walks, he first slightly bends the articulations of the hind legs, and then extends them, in order to carry forward the body, which motion is considerably aided by the extensors of the knee and the heel. The breast being thus thrown forward, the fore legs incline backward, and the animal would fall, did it not instantly throw them forward in order to support itself. It then draws up the trunk upon the fore legs, and renews its former efforts.

In this walking, each step is performed by two legs, one belonging to the fore, and the other to the hind pair. Sometimes these are of the same side, and sometimes those of opposite sides. The motion of a horse who steps forward in the latter way, is termed a pace.

In the animals that have the fore feet longer than the hind, and have their strength chiefly in the anterior part of the body, the principal impulse is given by extending the fore foot. The hind foot then rises to follow it, and it is not until the moment that the latter extends itself in its turn, that the fore foot is raised. This is the manner in which the *giraffe* is said to move.

But when the fore legs are considerably disproportioned to the others, and particularly when the posterior extremities are feebly and badly articulated, as in the sloths, the animal is obliged to drag itself forward, by first extending the fore legs, and then bending them so as to draw the body after them. Hence the progression of the sloth is so laborious.

Those animals which have their fore legs very short in proportion to their hind legs, would be incapable of sufficiently supporting their bodies, and must fall forward on each impulse of the latter, had they not the precaution to make a prancing movement; that is, to raise the anterior extremities entirely off the ground, previously to their being impelled onward by means of the hind feet. Accordingly, such animals cannot in propriety of language be said to walk; they only move forward by leaps. This is the case with hares, rats, and particularly jerboas. Indeed, these animals cannot be said to walk at all, except in the action of ascending. When they attempt to walk slowly on level ground, they are obliged to move themselves by the fore feet, and merely to drag after them the hind pair. This may be observed in rabbits, and still more distinctly in frogs.

138 Leaping.

In leaping, the body rises completely from the earth, and remains without any support for a short period, the duration of which depends on the force with which the leap has been made. This action is performed by a sudden extension of all the muscles belonging to the sacral articulations, immediately after they have undergone an unusual degree of flection. By this general extension these articulations receive a violent motion, the impulse of which is communicated to the centre of gravity of the body, and it is thus projected with a determined velocity, which is more or less in opposition to its weight. The projectile force and extent of the leap depend on the proportional length of the bones, and strength of the muscles. Those animals, therefore, leap best that have the sacral extremities longer and thicker than the atlantal; as the *kangaroos*, *jerboas*, *frogs*, *alticæ*, *grylli*, *fleas*, &c.

Small animals leap proportionally much farther than the larger species; and we know of none whose muscular strength, in this way, can be put in competition with that of a flea, which in a moderate computation is known to leap to a distance of at least 200 times its own length. The direction of a leap depends on the situation of the centre of gravity with respect to the member by which the impulse is given. Hence, only man and birds can leap vertically, because they alone have the trunk situated above the members by which the leap is effected. Quadrupeds, and most insects, can only leap forward; but spiders, which have several long feet on each side of their body, can also leap sideways.

139 Running.

Running consists of a series of low leaps performed alternately by each leg. It differs from walking, in the body being projected forward at each step, and in the hind foot being raised before the anterior touches the ground. It is more rapid than the quickest walk, because the acquired velocity is preserved, and increased at each bound by a new velocity. Running, therefore, cannot be instantaneously suspended, though a stop may be put to walking at each step.

In running, the animal inclines its body forward, that the centre of gravity may be in a proper position for receiving an impulse in that direction from the hind leg; and it is obliged to move the fore leg rapidly forward, to guard against falling.

Man varies his manner of running, only by taking longer or shorter steps, or giving to this motion a greater or less degree of rapidity; but quadrupeds vary this motion by the different order in which they raise each foot, or bring it to the ground.

140 Trotting.

Trotting is a mode of running in which the feet diagonally opposite rise at once, and fall at once, each pair alternately, but in such a manner, that for a moment all the four feet are off the ground. This produces a regular motion, and the sound of the animal's steps are heard two and two in succession.

141 Galloping.

Galloping is a running motion in which the animal raises the anterior feet at each step, and throws the body forward by the extension of the posterior feet. When the two fore-feet descend at the same time, and are followed by the two hind feet also descending together, the motion is called a *full gallop*, which is the most rapid a *horse* can perform, and the only mode of running in *dogs*, *hares*, &c. In this kind of gallop the steps of the horse are likewise heard by two beats at a time. The *common gallop* is when the two fore-feet are lifted unequally, and fall one after another. This may be divided into *gallops* in which the horses footsteps are heard by a series of three or four beats, because the posterior feet may fall to the ground either both together, or one after the other.

There are several kinds of animals which leap by the means of organs different from feet, but always by a sudden extension of several articulations.

Serpents leap by folding their bodies into several undulations, which they unbend all at once, according as they wish to give more or less velocity to their motion; some may be assisted by the scales of their belly, which they can elevate and depress, but only a few genera are capable of employing this means.

Some fishes also leap to the tops of cataracts by bending their bodies strongly, and afterwards unbending them with an elastic spring.

The long-tailed *cray-fishes*, particularly the *shrimps*, leap by extending the tail after it has been previously bent under the body.

The larva of the *fly*, vulgarly called the maggot, forms itself into a circle, contracts itself as much as possible, then suddenly unbending, darts forwards to a considerable distance.

142 **Climbing.** The motion of climbing, so useful to many of the inferior animals, consists, in hanging from, and strongly grasping any object susceptible of being seized by the fingers, toes, or tail, and thus rising, by successive efforts, in a direction opposite to the animal's weight. From this explanation, it is evident that those animals which have the divisions of their extremities most distinct and flexible, will be the best climbers; and accordingly we find that the animals called *quadrumanous*, as the apes, lemurs, and a few others, perform this action in the most perfect manner. Man is but an indifferent climber, as he can only grasp with his hands. In *oppossums*, *ant-eaters* and *sloths*, one of the toes is distinct, like the thumb in man, apes, and lemurs; or else they have a considerable protuberance on the heel, which has the same effect. Many animals, as some of the *monkeys*, some species of *oppossum* and *ant-eater*, the *manis*, &c. have a very flexible prehensile tail, which assists them in climbing. The animals of the cat genus have very sharp talons, by which they are materially assisted in this kind of progression, as they enable them to adhere firmly to the bark of trees, &c. Creepers, nut-hatches, woodpeckers, and other climbing birds, support themselves in a similar manner.

143 **Flying.** The motion of flying, by which an animal can support itself for some considerable time in the air, can properly be said to be performed only by birds: for though bats can imitate this motion with tolerable success, and the galiopithecus, flying squirrels, and flying oppossums, appear to fly from one tree to another, the motion of the former cannot be supported for so long a time as that of birds; and the motion of the latter animals can be considered only as a leap, assisted and prolonged by the opposition given to the air, by the membranous expansion between their limbs.

When a bird designs to fly, it first darts into the air, either by leaping from the ground, or by throwing itself from some height. In the mean time it raises the whole of the wings which had till then remained folded, and which it unfolds in a horizontal direction by extending the bones. When the wings have thus acquired all the superficial extent of which they are susceptible, they are suddenly depressed, till they form, with the vertical plane of the body, an angle that is obtuse upward, and acute downward. The resistance which the air gives to this motion suddenly performed in it, produces a reaction on the body of the bird, and thus moves it forward as in ordinary leaps. This impulse once given, the bird refolds the wings by bending the joints, and repeats its efforts by another stroke. As the velocity thus acquired in ascending is gradually diminished by the effect of gravitation, a moment occurs in which it ceases, and in which the bird tends neither to ascend nor descend. If at this moment it gives a new stroke with the wings, it acquires a new ascending velocity, by which it will be carried as far as before, and by repeating these efforts, it will ascend in a uniform manner. If this second stroke be made before the velocity first acquired is lost, an additional impulse will be received; and by a continuance of this action the bird will ascend with an accelerated motion. If the wings do not vibrate when the ascending velocity is lost, the bird will begin to descend; and if it allow itself to fall down to the point from which it set out, it cannot ascend as high as at first, but by a much stronger exertion of the wings; but if it seizes in the fall a point so situated that the acquired descending velocity, and the small space which it has to fall down reciprocally balance each other, it may, by a series of equal vibrations, keep itself at the same height.

When a bird wishes to descend rapidly, as when it darts upon its prey, it altogether suppresses the vibration of its wings, and thus falls by its own gravity. While descending, however, it may suddenly break its fall by extending its wings, and this suspension is called a *recover*.

We have as yet considered only the vertical flight of a bird. To fly horizontally, it must rise in an oblique direction, and make a new movement of its wings, when it is ready to descend below the point from which it departed; but in this way it will not fly in a straight line, but will describe a series of curves so very much depressed, that the horizontal will overcome the vertical motion. In order to ascend obliquely, the bird must make quicker vibrations of its wings, and to ascend in a similar direction, the vibrations must be slower.

The deviations of flight to the right or left are chiefly produced by the unequal vibrations of the opposite wing; those of the left wing carrying the bird to the right, and *vice versa*. The more rapid the flight is forward, the greater is the difficulty of one wing surpassing the other in the velocity of its vibrations, and of course the deviation sideways is the more difficult. Hence birds which fly with the greatest velocity make large circles in turning.

The tail, when spread out, contributes to sustain the posterior part of the body. If it is depressed when the bird has acquired a progressive velocity, it presents an obstacle which elevates the posterior part of the body, and depresses the anterior. If it is turned up, the contrary effect is produced. Some birds incline to one side, to assist them like a rudder, when they wish to change their horizontal direction.

The structure of most birds peculiarly adapts them for rapid motion through the air, and for sustaining themselves in this element with the greatest facility. See ORNITHOLOGY, N° 37.

144 **Swimming.** The action of swimming, like that of flying, nearly resembles leaping, except that, like flying, the leap does not take place on a fixed surface. A great variety of animals, besides fish, and most of the other inhabitants of the waters, are capable of swimming. This action is performed with considerable ease by several of the mammalia,

malia, even by the bulky elephant, and the unwieldy hippopotamus; by many tribes of birds; by several reptiles and serpents, and by some insects.

The organs employed by fishes, in making their way through the water, are their fins, tail, and air-bladder; the two former exerting the necessary motions like the wings of birds, while the latter, by being compressed or expanded, causes the necessary changes in the specific gravity of the body, and thereby renders the animal more or less buoyant. The swimming of fishes has been treated of with sufficient minuteness under ICHTHYOLOGY, chap. iii. sect. 3. to which we refer the reader.

The cetacea employ much the same means as fishes; but in them the principal efforts of the tail are made in a vertical direction, and the use of the air-bag is supplied by lungs, which they can compress and dilate at pleasure, by the action of the diaphragm, or the intercostal muscles. See CETOLOGY.

The swimming of mammalia, and of water birds, is performed by means of the legs and feet, which are used like oars, to propel the body forward by the resistance which they make to the water in the contrary direction. Hence those quadrupeds and birds that have flat or webbed feet, swim most easily, as the resisting surface is the greatest. Of all the mammalia, man has the most occasion to use his hands in swimming, on account of the greater proportional weight of his head.

Serpents, and the larvæ of such insects as sometimes inhabit the waters, perform the action of swimming by rapid inflections of the body like an eel or a leech. The larvæ that are most commonly found in the waters are those of the water *beetles*, the *hydrophilus*, the *day flies*, the *aquatic tipulæ*, and *gnats*.

145. No animal walks without legs, or flies without wings (if we except the flying fish, whose fins enable it rather to spring than fly); but there are many that swim without fins, and that leap or creep without any legs. The rapidity of movement is not proportioned to the number of instruments that are employed: if the spout-fish be observed to move slowly with one leg, the sea-urchin moves still more slowly with many thousands; the oyster moves by squirting out water; the scallop by the jerk of its shell, and when in the water it rises to the surface and sails before the wind.

Many animals are formed by nature to fly, walk, leap, and swim: the fate of those are rather uncommon whose muscles or feet are by nature attached to their integuments; the lobster is obliged to throw off its shell, and the caterpillar all its feet, with the skins, and in that situation to remain stationary till it receive new instruments of motion.

146 Whoever has read the celebrated work *De Motu Animalium*, needs not to be told that, besides the organs which are here mentioned, the form, the structure, and even the specific gravity of the body, as depending on the nature of the bones and muscles, or as varied by air-vesicles and bubbles; with a great variety of other circumstances, are necessary to explain the different phenomena of locomotion.

147 **Vegetable motions.** As to vegetable motions, they evidently depend on external agents: the wings of seeds only fit them to be carried by the wind, their specific gravity to float in the water, and their legs or tentacula to adhere to bodies that are in motion; the singular motions which have been ascribed to sleeping, to waking, to sensation, and volition, in the vegetable kingdom, seem only the consequence of light, heat, moisture, and such stimulants, acting invisibly or with secret influence: the opening and closing of the meteoric flowers are always correspondent to the states of the atmosphere; and the opening and closing of the equinoctial and tropic flowers, to the light, the length or shortness of the day.

148 **Uses of locomotion.** The principal intentions of locomotion are to get food, to shun danger, to promote intercourse and disperse the species.

There is perhaps no part of physiology which is more important than the relations which subsist between the different functions of the living body; but it is a part of the subject which is as yet but little understood. We regret that our limits will not permit us to pay all the attention to it which we could wish. We shall, however, briefly notice under each function, the principal relations that are found to take place between it and those which have been previously considered.

149 **Mutual relations between sensation and motion.** Besides the dependence which animal motion has, in most instances, on the nervous system, (see N° 111.) we find an evident sympathy between these two functions in a variety of phenomena. A violent emotion or impression on the nerves often throws the limbs into convulsive agitations; spasmodic affections are relieved, or sometimes removed, by the coming on of delirium; and these symptoms will alternate with each other: a compression of the brain, or of some large nervous trunk, produces general or partial want of motion, and when this compression is removed, the muscles for the most part recover their usual action; an attack of epilepsy is often preceded by the sensation of a stream of vapour commencing in some external part, and rising to the brain. These, and many other phenomena that might be mentioned, fully prove the sympathy between the nervous and muscular systems; and with this enumeration we must dismiss the subject.

CHAP. V. *Of Digestion.*

150 **Appetite for food.** THE necessity of repairing the waste of the body is announced in all animals by the feelings of hunger and thirst; the former of which intimates the occasion for solid, the latter for liquid food. This imperious necessity overrules all the other affections of the vital principle, and every other appetite often remains suspended till that necessity be satisfied. It is difficult to assign the final cause of these singular sensations, but probably our researches on that subject are rather curious than useful. Whatever be the ultimate end of these appetites, we readily perceive how much they are influenced by habit. We find that when we are accustomed to take food at particular times, the appetite, under ordinary circumstances, always reminds us at these times, of the occasion, whether real or apparent, for receiving a new supply. By this influence of habit some animals, especially man, are accustomed to take several meals in a day, while others can fast for days, or even weeks, together. The appetite for food also varies considerably at different ages. It is more lively and more imperious in infancy and early childhood, and in general in those animals who have not yet acquired their full growth; it is on the contrary weaker in advanced age, and when the body ceases to

increase in size. It is more frequently renewed in the strong and healthy, and those who are accustomed to laborious occupations or active exercises.

151 We know that in the natural state of the animal body, the appetite for food is influenced by the nature of the aliment on which the animal is accustomed to subsist. Many animals live entirely on vegetable food, and these have no appetite for animal substances, and even reject these when offered to them. On the other hand, many tribes live entirely on animal food, and either refuse vegetable, or, if obliged by necessity to employ it as food, do not appear to derive nourishment from it. We find, however, that it is in the power of habit to remove these appetites; that a horse or a sheep may be taught to live on animal food, while a dog or a cat may be supported entirely on vegetable substances. A few animals are capable of subsisting on almost every kind of animal or vegetable substances, or are omnivorous.

152 Plants and some animals live on water and air alone.

Many animals are capable of being supported by water and air alone. We know that several fishes, as the minow, the gold and silver fish, &c. will live for a long time in a vessel containing pure water, and freely exposed to the air. Rondelet a celebrated writer on fishes in the 16th century) relates a remarkable instance of this. He kept a fish during three years in a vessel that was constantly full of very pure water. It grew to such a size, that at the end of that time the vessel could no longer contain it. Leeches are often kept for several years with no other nutriment but water, and that not very often changed. There is good reason to believe that the sole food of plants consists of water and air, and that the soil in which they grow answers scarcely any other purpose than that of preserving and conducting those necessary aliments.

153 It has been supposed that some animals are capable of subsisting on matters that appear to contain no nutritious principles, such as sand, hair, and wool. Borelli long ago conceived this opinion, from observing that in many testaceous animals which he dissected, the alimentary tube contained nothing but sand. It has often been remarked, that horses, cows, and sheep, when deprived of their usual nourishment, will lick their bodies, and swallow down the hair, or, in the case of sheep, will tear off and swallow each others wool. If we consider the nature of these substances, we think there is no reason to suppose that they answer any other purpose than distending the alimentary canal or stomach, and thus in some measure counteracting the effect of hunger.

The subject of food in general has been already treated of, under ALIMENT, and in MATERIA MEDICA, Part I. N° 17; and the function of digestion, as far as it relates to man, has been considered under ANATOMY, N° 106, 107, and under CHEMISTRY, N° 2548. It remains for us here only to make a few observations on the comparative physiology of this function.

154 Differences of digestion

Digestion differs considerably in the various classes of animals, both as to the organs by which it is performed, and as to the simplicity or complex nature of the operation itself. The general variations that take place in the organs of digestion, have been mentioned under the comparative part of ANATOMY, N° 152, and are fully treated of by Cuvier, in his *Leçons d'Anatomie Comparée*, tom. iii. and Blumenbach, in his *Comparative Anatomy*, chap. 6. and 7.

In the more perfect animals, digestion supposes a series of operations, from the time that the food enters the mouth, till the nutritious parts of it are taken into the circulating system. These operations are, *mastication*, *insalivation*, *deglutition*, *chymification*, and *chylification*.

155 Mastication.

Mastication is performed by means of teeth, and therefore can scarcely be said to take place in those animals that are not furnished with these organs. We know that all mammalia, except those which Cuvier calls *edentata*, as the ant-eaters, pangolins, and platypus, have teeth, fitted both for dividing and chewing their food; but here an important difference takes place. Those animals which live chiefly on animal food, have most of their teeth sharp and pointed, for the purpose of seizing and tearing their prey, while the graminivorous and granivorous animals have very large and strong grinders, in which the hard substance commonly called enamel (or what Blake calls *corpus striatum*,*) forms alternate layers with the bony part. Such are also found in most reptiles and serpents, and in many fishes; but in some of these they seem less to serve the purpose of dividing the food, than to seize and retain it till swallowed. Birds have no teeth, though some of them have the mandibles of the bill so formed as to divide and cut in pieces their food.

156 Insalivation.

During mastication the food is mixed with the saliva, and is thus better fitted for easy solution in the stomach. This insalivation of the food may, however, take place, without previous mastication. It is common for serpents to swallow their food whole; but in order to facilitate its passage down the throat, they first besmear it all over with their muscous saliva. In many animals, a process similar to insalivation takes place, while the food remains in the mouth. In several species of the ape tribe there is a pouch situated on each side of the jaw, and in these pouches the greater part of the food is retained, not merely as some suppose, to serve as a future meal, but to undergo a dilution by the fluids that are there secreted. In granivorous birds, the food is first received into a membranous bag, formed by a dilatation of the gullet, and commonly called the *crop*, where it is macerated by the fluids that are there separated by means of glands or exhaling vessels, and passes down, as the animal requires, to be further prepared by the stomach. The bustard, indeed, though a granivorous bird, has no proper crop, but the gullet is furnished with numerous and large glands.

For an account of the chemical nature and properties of saliva, see CHEMISTRY, N° 2723.

157 Deglutition.

The operation of deglutition depends chiefly on the action of the tongue, and on that of the muscles which surround the pharynx and gullet. It is more or less speedy in proportion as these are more or less active and vigorous. Most animals, after having once swallowed their food, do not receive it again into the mouth; but this takes place in several tribes, and is called *rumination*, or chewing the *cud*.

158 Rumination.

Rumination takes place chiefly in those animals that feed on herbage, and have not a muscular stomach; such as all the tribes that Linnæus has ranked under the order *pecora*. In these the food, after being slightly chewed, is received into the first stomach, and after remaining there for a short time, it is gradually brought by a retrograde action of the gullet into the mouth, where it undergoes a complete trituration and insalivation,

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* *Blake on the Structure and Formation of the Teeth.*

tion, and is then conveyed into the 2d, 3d, and 4th stomachs, to be mixed with the gastric juice.

Some of those birds which have a diluting sac or ingluvies, seem likewise to ruminate. This in the parrot was observed by the gentlemen of the French academy. It has since been observed in rooks, macaws, cockatoos, and others: and Mr Hunter, to whom physiology is so much indebted, discovered that the male and the female pigeon secrete in their ingluvies a certain liquor for feeding their young; and that most kinds of what have been thought ruminating birds do very often in expressing their fondness regurgitate their food. Yet both this and another species of regurgitation which is very common with those animals that swallow indigestible substances with their food, should be carefully distinguished from rumination. For a farther account of rumination, and of the digestive organs of ruminating animals, see *Comparative* ANATOMY, N° 228—234. and *Phil. Trans.* 1807, Part ii.

159 **Chymification.**

The food having entered the stomach, undergoes in that organ processes that are partly mechanical, or rather organic, and partly chemical, depending on the structure of the stomach, and the nature of the juices secreted into its cavity. By these actions it is reduced into a pulpy substance commonly called *chyme*.

160 **Organic action of the stomach.**

The organic action of the stomach is greater or less, according as this organ is more or less muscular. There are many animals, chiefly birds of the granivorous tribes, that have a very muscular stomach, commonly called *gizzard*, capable of grinding, not only the grains received into it, but even of reducing to powder small pieces of glass, and of blunting the points of needles and lancets. These facts were first proved by Borelli, who introduced into the gizzards of fowls, nuts, filberts, hollow spheres of glass, hollow cubes of lead, small pyramids of wood, and several other substances, which he found were either crushed together, or broken to pieces. He computes the power exerted by the stomach of the Indian cock as equal to the pressure of 1350 pounds weight. These experiments were repeated and verified by Spallanzani.

Some animals that are not possessed of a muscular stomach have, within that organ, teeth, or other hard bodies, for the purpose of breaking or grinding their food. This is the case with many of the crustacea, as crabs and lobsters.

A great many animals have what Spallanzani calls *intermediate* stomachs, i. e. not so muscular as the gizzard of fowls, nor so membranous as the stomachs of ruminating animals; this is the case with many birds, as ravens, crows, herons, &c. The stomachs of these animals are possessed of considerable force, though this is not nearly equal to that exerted by the gizzard. These animals possess the power of rejecting by the mouth the substances that are incapable of digestion in the stomach, every nine, or sometimes every three hours.

The animals with membranous stomachs are very numerous, comprehending man, most beasts and birds of prey; many reptiles, snakes, fish, &c. The stomachs of these animals are susceptible of but little muscular action, though in many species they both contract upon the food, and reject it through the gullet, on various occasions. Birds of prey, like the ravens, crows, &c. possess the power of rejecting, in the form of pellets, the indigestible parts of their food, which usually takes place every 24 hours.

161 **Discoveries of Mr Home.**

A most interesting paper by Mr Everard Home is published in the Philosophical Transactions for 1807, part ii. on the structure and functions of the stomachs of various animals. We regret that we can here give little more than the results of his inquiries.

From previous investigations respecting the stomachs of ruminating animals, Mr Home was led to believe that the fourth stomach in these tribes was either always, or during digestion, divided into two portions, each performing a different office in the digestive process; and he even conjectured, that a similar division might take place in other animals.

Mr Home has examined the stomachs of a great variety of animals, and investigated the progress of digestion in *ruminants*, the *hare* tribe, which occasionally ruminate, the *beaver*, *dormouse*, *water-rat*, *common rat*, *mouse*, *horse*, and *ass*, *kangaroo*, *pecaré*, *hippopotamus*, *elephant*, the *cetacea*, *fowls*, and lastly in *man*.

162 **Human stomach the link between carnivorous and phitivorous stomachs.**

The human stomach appears to be the uniting link between those that are fitted only to digest vegetable substances, and those of animals that are entirely carnivorous; and yet we find, that in its internal structure it is in every material respect similar both to those of the monkey and squirrel, which usually digest only vegetable food, and to those of carnivorous animals.

163 **Into a *cardiac* and *pyloric* portion.**

The human stomach is occasionally divided into a *cardiac* and a *pyloric* portion, by a muscular contraction similar to those of other animals; and as this circumstance has not before been noticed, it is proper to be more particular in describing it.

The first instance in which Mr Home observed this muscular contraction in the human stomach, was in a woman who died in consequence of being burnt, and who had been unable to take much nourishment for several days before her death. The stomach was found empty, and was taken out of the body at a very early period after death. It was carefully inverted to expose its internal surface, and gently distended with air. The contraction was so permanent, that after the stomach had been kept in water, in an inverted state, for several days, and at different times distended with air, the appearance was not altogether destroyed.

Since that time, Mr Home has taken every opportunity of examining the human stomach shortly after death; and he finds that this contraction, in a greater or less degree, is very generally met with. He is of opinion that this effect is not produced by a peculiar band of muscular fibres, but that it arises from the muscular coat, in the middle part of the stomach, being thrown into action to a greater or less extent according to circumstances. When this part of the stomach is examined by dissection, its muscular fibres are not to be distinguished from the rest. If the body be examined so late as 24 hours after death, this appearance is rarely met with; a circumstance which accounts for its not having before been particularly noticed.

164 **Food first dissolved in the cardiac portion;**

That the food is dissolved in the *cardiac* portion of the human stomach, is proved by this part only being found digested after death; the instances of which are sufficiently numerous to require no addition being made to them. This could not take place unless the solvent liquor was deposited there. Mr Hunter goes so far as to say in his paper on this subject, "there are few dead bodies in which the stomach at its great end is not in some degree digested."

165
but the chyle formed in the pyloric portion.

That the chyle is not formed there, and that it is commonly formed before the food passes through the *pylorus*, is proved by the result of some experiments made by Mr Hunter upon dogs, in the year 1760. The dogs were killed while digestion was going on; and in all, the food was least dissolved, or even mixed, towards the great end of the stomach, but became more and more so towards the *pylorus*, just within which it was mixed with a whitish fluid like cream.

166
Solvent liquor secreted by glands near the gullet.

From the result of these experiments, as well as from the analogy of other animals, it is reasonable to believe, that the glands situated at the termination of the cuticular lining of the œsophagus, which are described by Mr Home, secrete the solvent liquor, which is occasionally poured on the food, so as to be intimately mixed with it before it is removed from the cardiac portion; and the muscular contraction retains it there, till this takes place.

167
Curvature of the stomach accounted for.

Such contraction being occasionally required in the stomach, accounts for its being more or less bent upon itself, as by this structure it is more readily divided into two portions, by the action of the muscular fibres at that part where the angle is formed.

This contraction also explains why the contents of the stomach are not completely discharged from the first effect of an emetic; and by it Mr Home thinks we may explain the cramp of the stomach, and some kinds of indigestion.

168
Ornithorinchus the real link between quadrupeds and birds.

After comparing the stomachs of several carnivorous animals with that of man; in tracing the gradation from carnivorous beasts through the bat tribe to birds of prey, Mr Home remarks, that "the only real link between the stomachs of quadrupeds and birds is that of the ornithorinchus (or platypus), which, however, is more an approach to the gizzard, being lined with a cuticle containing sand, and having the same relative situation to the œsophagus and duodenum. The food of this animal is not known; it is probably of both kinds; the papillæ at the pylorus, which appear to be the secretory ducts of glands, are peculiar to it.

169
General conclusions.

From the facts and observations brought forward in this valuable paper, Mr Home deduces the following general conclusions. "That the solvent liquor is secreted from glands of a somewhat similar structure in all animals, but much larger and more conspicuous in some than in others.

"That these glands are always situated near the orifice of the cavity, the contents of which are exposed to their secretion.

"That the viscid substance found on the internal membrane of all the stomachs that were examined recently after death, is reduced to this state by a secretion from the whole surface of the stomach, which coagulates albumen. This appears to be proved, by every part of the fourth cavity of the calf's stomach having the property of coagulating milk.

"This property in the general secretion of the stomach leads to an opinion, that the coagulation of fluid substances is necessary for their being acted on by the solvent liquor; and a practical observation of the late Mr Hunter, that weak stomachs can digest only solid food, is in confirmation of it.

"That in converting animal and vegetable substances into chyle, the food is first intimately mixed with the general secretions of the stomach, and after it has been acted on by them, the solvent liquor is poured upon it, by which the nutritious part is dissolved. This solution is afterwards conveyed into the pyloric portion, where it is mixed with the secretions peculiar to that cavity, and converted into chyle.

"The great strength of the muscles of the pyloric portion of some stomachs will, by their action, compress the contents, and separate the chyle from the indigestible part of the food.

"In animals whose food is easy of digestion, the stomach consists of a cardiac and pyloric portion only; but in those whose food is difficult of digestion, other parts are superadded, in which it undergoes a preparation before it is submitted to that process."

170
Action of the gastric juice.

The action of the juices of the stomach, or of what we call the *gastric juice*, appears to have much more effect in the process of chymification, than the muscular action of the stomach, though the dissolving power of this fluid seems to be proportionally less in those animals that have the most muscular stomachs. The gastric juice of granivorous birds is capable of dissolving flesh; but when this is entire, it requires four or five days for solution; whereas when bruised, half that time is sufficient. Even grain is not dissolved in it except when bruised. The gastric juice of animals with intermediate stomachs dissolves flesh and cartilage, but not bone. It is incapable of dissolving entire seeds. In animals with membranous stomachs, the gastric juice is extremely active, and seems to be almost the only agent in the digestive process. In some of these animals, however, as the ruminating tribes, this fluid has no effect on the food, unless it be bruised, or thoroughly masticated. Spallanzani found, that owls digest flesh and bones, but not grain;—that the gastric juice of the eagle dissolves bread and bone, and even animal and vegetable matters, when it is taken out of the body;—that a wood pigeon may be gradually brought to live on flesh;—that the owl and falcon do not digest bread;—that the gastric juice of the dog dissolves even the enamel of the teeth.

Hence, in every order of animals, the gastric juice is the principal cause of digestion, and it agrees in all in many properties, and differs in others. In the frog, the newt, scaly fishes, and other cold-blooded animals, it produces digestion in a temperature nearly equal to that of the atmosphere. In warm-blooded animals it is capable of dissolving the aliment in a degree of heat lower than that of these animals. In them too the food is digested in a few hours, whereas in the opposite kind it requires several days, and even weeks, particularly in serpents; likewise, the gastric juice of the gallinaceous class can dissolve only bodies of a soft and yielding texture, and previously triturated: whilst in others, as serpents, the heron, birds of prey, and the dog, it decomposes substances of great tenacity, as ligaments and tendons; and even of considerable hardness, as the most compact bone. Man belongs to this class, but his gastric juice seems to have no action on the hardest kinds of bones. Some species, likewise, are incapable of digesting vegetables, as birds of prey; but man, the dog, cat, crows, &c. dissolve the individuals of both kingdoms alike, and are omnivorous, and in general their gastric juices produce these effects out of the body.

For an account of the chemical nature and properties of the gastric juice, see Chemistry, N° 2551.

171 Solubility of foods.

The process of chymification depends also, in a great measure, on the nature of the substances employed as food, as some of these are much more soluble than others. On this subject much information may be derived by consulting the experiments of Dr Stark *, and these of M. Gosse of Geneva, an abstract of which is given in Johnson's Animal Chemistry, vol. i. p. 207. From the latter experiments it appears, 1*st*, That the following substances are either insoluble, or are not digested in the usual time in the stomach.

Animal substances. 1. Tendinous parts. 2. Bones. 3. Oily or fatty parts. 4. Indurated white of egg.

Vegetable substances. 1. Oily or emulsive seeds. 2. Expressed oils of different nuts and kernels. 3. Dried grapes. 4. Rind of farinaceous substances. 5. Pods of beans and pease. 6. Skins of stone fruits. 7. Husks of fruit, with grains or seeds. 8. Capsules of fruit, with grains. 9. Ligneous stones of fruits. 10. The gastric juice does not destroy the life of some seeds; hence bitter-sweet, hemp, misletoe, and other plants which sometimes grow upon trees, are produced by the means of the excrements of birds, the kernels of seeds being defended from the menstruum by their exterior covering.

2*d*, That the following are partly soluble, viz.

Animal substances. 1. Pork dressed various ways. 2. Black puddings. 3. Fritters of eggs, fried eggs and bacon.

Vegetable Substances.—1. Salads of different kinds, rendered more so when dressed. 2. White of cabbage less soluble than red. 3. Beet, cardoons, onions, and leeks. 4. Root of scurvy-grass, red and yellow carrots, succory, are more insoluble in the form of salad than any other way. 5. Pulp of fruit with acids, when not fluid. 6. Warm bread and sweet pastry, from their producing acidity. 7. Fresh and dry figs. By frying all these substances in butter or oil they become still less soluble. If they are not dissolved in the stomach, they are, however, in the course of their passage through the intestines.

3*d*, That the following are soluble, or easy of digestion, being generally reduced to chyme in an hour, or an hour and a half.

Animal Substances.—1. Veal, lamb, and in general the flesh of young animals, are sooner dissolved than that of old. 2. Fresh eggs. 3. Cows milk. 4. Perch boiled with a little salt and parsley. When fried or seasoned with oil, wine, and white sauce, it is not so soluble.

Vegetable Substances.—1. Herbs, as spinach, mixed with sorrel, are less soluble. Celery. Tops of asparagus, hops, and the ornithogalus of the Pyrenees. 2. Bottom of artichokes. 3. Boiled pulp of fruits, seasoned with sugar. 4. Pulp or meal of farinaceous seeds. 5. Different sorts of wheaten bread, without butter, the second day after baking; the crust more so than the crumb. Salted bread of Geneva more so than that of Paris without salt; brown bread in proportion as it contains more bran is less soluble. 6. Rapes, turnips, potatoes, parsnips, not too old. 7. Gum arabic, but its acid is soon felt. The Arabians use it as food.

The solvent power of the gastric juice is increased by various stimulants, especially by those called *condiments*, as sea salt, spices, mustard, vinegar, as well as by vinous and spirituous liquors and old cheese in small quantities, and by various bitters. It is retarded by large quantities of diluting liquors, especially when taken hot; by acids and astringents taken a short time after eating; by unctuous substances; by mental employment, or severe bodily exercise, too soon after a meal; and by leaning with the breast against a table.

172 Various theories of digestion.

It may be proper here to notice the various opinions that have been entertained respecting the immediate cause of digestion. The principal of these opinions are, that it is produced by coction or heat; by trituration in the stomach; by fermentation, or by putrefaction.

173 Heat.

That it is not brought about by heat alone, will appear from the circumstance, that many cold-blooded animals digest their food as completely, though not so expeditiously, as warm-blooded animals.

174 Trituration.

That it is not effected by trituration in the stomach alone, is evident from the experiments that have been made by Spallanzani, Stevens, and others, of giving to animals food enclosed in hollow perforated balls, sufficiently strong to resist the muscular power of the stomach; as the balls have been found empty, and not compressed.

175 Fermentation.

That it is not owing to fermentation is proved by the circumstance, that the more perfectly digestion proceeds, the less is the evolution of gases in the stomach; the contrary of which would be the case, if digestion consisted in a fermentation of the aliment.

176 Putridity.

That it does not depend on putridity, is evidenced by the observations that have been made on putrid food given to dogs, and examined some time after, when it was found perfectly sweet.

On the whole it appears, that in most animals the digestion of food in the stomach depends partly on a due degree of heat, partly on the vital action of the stomach, but chiefly on the action of the gastric juice.

177 Chylification.

When the aliments have been converted in the stomach to the crude pulp called *chyme*, they are gradually propelled through the *pylorus* into the duodenum, where they are mixed with the bile, the pancreatic juice, and the fluids that are separated by the mucous coat of that intestine, and are thus reduced to a still finer pulp, containing, as one of its principal ingredients, the nutritious fluid called *chyle*, the nature and properties of which, as they have been but slightly mentioned in the former parts of this work, fall to be noticed here.

178 Properties of chyle.

The properties of chyle have not been minutely investigated; but according to Fordyce, as far as experiment has been carried, the chyle of quadrupeds is so similar to that of man, and of each other, as hardly to be distinguished, even in tribes the most opposite to each other in their structure, food, and habits of life. As far as we can perceive, the chyle of a dog or a wolf differs in nothing from that of a sheep or an ox.

The chyle consists of three parts; one part which is fluid, and contained in the lacteals, but coagulates on extravasation.

The second part consists of a fluid, which is coagulable by heat, and in all its properties hitherto observed, it is similar to the serum of the blood.

The third part consists of globules, which render the whole white and opake. These globules have been supposed by many to be an expressed oil; but this has not been proved. Neither has it been perfectly demonstrated that sugar is contained in the chyle, although it has been

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* *Stark's Works.*

been made very probable. The difficulty of determining these points arises from the small quantity that can be collected, the largest animals not supplying more than one ounce or two, at the most. However, the part coagulating on extravasation; the part agreeing with serum in its qualities; the globular part, which in some animals, but not in quadrupeds, exists without giving whiteness to the chyle—alone, or along with sugar, form the essential parts of the chyle *.

* *Fordyce on Digestion.*

179 Progress of the chyle.

The compound pulpy matter containing the chyle is carried forward from the duodenum through the whole course of the intestines, where it is subjected to the continual action of the internal wrinkled membrane of the bowels, and its nutritious particles, or chyle, selected and absorbed by the lacteals that are abundantly distributed there, and open their mouths directly within the cavity.

180 Passage of food through the intestines.

As to the movements of the alimentary canal, the direction of hairs found in the stomach, and the balls of hairs which are thrown up, would appear to indicate a circular motion. The intestinal part has a motion similar to that of a worm, and is called the *vermicular* or *peristaltic*. Here every portion retains its own motion, although it be separated from the rest by ligatures. The stomach of the polype, the gullets of the ruminating kinds, and the cæca, have the motion in different directions at different times; and that observed in the alimentary canal of a louse is, when viewed through a microscope in the time of action, amazingly rapid; the stimulating causes employed are the food, the different liquors with which it is mixed, the air, the nerves where they exist, and a portion of heat. Some degree of heat is necessary to every process of digestion, both in the animal and vegetable kingdom; what that degree is depends on the nature of the living body; and is various according to its age, its health, its employments and habits.

With respect to the function of digestion in the lower classes of animals, we can say but little. We know that their food is dissolved in the stomachs of the crustacea, of mollusca, and of polypes; but whether this process in most insects and worms is any thing more than imbibition, or taking in aliment, which is to undergo little change, we are uncertain. We know, indeed, that many insects live on substances which must be dissolved before they enter into the pores of their bodies, and that many of them abound in acrid juices, which are well fitted for this solution. It does not appear that plants possess what may be called the faculty of digestion.

181 Relations between digestion and sensation.

The relations between digestion and the functions we have already considered, especially sensation, are various and important. The sympathies that exist between the head and the stomach, have been long acknowledged. Several affections of the brain are accompanied with sickness at the stomach, loss of appetite, and indigestion; while on the other hand, the deranged state of the digestive organs seldom fails to produce giddiness, headach, ringing in the ears, confusion or depravation of sight, &c.; and if the former symptoms arise to a great height, as in the case of overloaded stomach or surfeit, coma, or even apoplexy, is frequently produced. In many nervous affections, particularly hysteria and hypochondriasis, in which there frequently takes place astonishing accumulations of air in the stomach and bowels, the affections of the head, such as stupor, confusion of thought, partial blindness, &c. sometimes proceed to such a height, as to threaten, or even sometimes to produce, an apoplectic paroxysm. In many cases these affections are referred immediately to the head; but are proved, in most instances, to depend on the disordered state of the alimentary canal, from the immediate relief procured by those remedies which promote the discharge of air, or produce copious evacuation from the bowels. On the other hand, in some diseases, where the head is primarily affected, as in phrenitis hydrocephalica (water in the head), the complaint is referred to the bowels, from the costiveness or other disordered state of these. The daily experience of literary men shows how much intense thought diminishes the digestive powers, and how imperfectly studious occupations can be carried on after a full meal. The action of the digestive organs is also considerably influenced by the mind, or the passions. We know how readily the appetite may be diminished or destroyed by sudden anger or affliction.

The action of the stomach may even be influenced by the will. We have known a person who could vomit whenever he pleased; and Dr Darwin speaks of another who had acquired this voluntary command over the inverted motions of the stomach and throat, to such a degree, as to gain a subsistence by exhibiting these unnatural powers to the public. At these exhibitions he was accustomed to swallow a pint of red rough gooseberries, and a pint of white smooth ones; to bring them up in small parcels into his mouth, and restore them separately to the spectators, who called for red or white, as they pleased, till the whole were redelivered *.

* *Zoonomia*, vol i. p. 276.

The sympathies that take place between the brain and the digestive organs, are easily explained, from considering the distribution of the great sympathetic nerve, to illustrate which we have given a figure (fig. 1.) showing its course and distribution from the head through the chest, as far as the stomach.

Plate CCCCXVIII.

182 Relations between digestion and motion.

The relations between the digestive and the locomotive functions, are not less obvious. Experience shews how much digestion depends on regular exercise, and how imperfectly it is carried on in the stomach of the indolent and sedentary; while on the other hand, when the stomach is overloaded, voluntary motion becomes difficult and fatiguing. Spasmodic contractions of the muscles, twitchings of the limbs, and similar affections, are the common attendants of indigestion, though these may perhaps be referred equally to the nervous as to the muscular system.

183 Morbid affections of digestion.

The principal morbid affections of digestion are, nausea, flatulence, eructation, rumination (G), vomiting, heartburn,

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(G) That ruminating power which is natural to the quadrupeds of the order *Pecora*, is sometimes met with in man. We have heard of persons who regularly brought up their food into the mouth soon after eating, chewed it over again, swallowed the juices with the saliva, and spat out the more solid parts. In these cases, the rumination heartburn, water-brash or *pyrosis*, loss of appetite, and inordinate appetite; for an account of which, see the article MEDICINE.

CHAP VI. *Of Absorption.*

184 Absorption. WE have said that the chyle is taken up from the compound pulpy matter composed of the food and the animal juices, as it passes through the intestines, by the lacteals. This, however, is not the only absorption that takes place in the animal body. The fluids poured out into cavities by the exhalant arteries, as well as all the secreted or exuding fluids, and even the solid materials of the system, are taken up by the lymphatics, and carried into the circulation; the blood poured out into cells in some parts, is evidently absorbed by veins; and, as we shall endeavour to prove, an absorption takes place over the external surface of the body.

185 Organs. What is called the absorbent system, is composed, in the superior animals, of the *lacteals*, the *mesenteric glands*, the *thoracic duct*, the *lymphatics*, and the *lymphatic glands*. For an account of these in man, see ANATOMY, Part I. Sect. 14. This system, in a greater or less degree, is found in all animals, except some mollusca, insects, worms, and zoophytes. See Cuvier's *Leçons*, tom. iv. leç. xxiii. and Blumenbach's *Comparative Anatomy*, chap. xiii.

186 By lacteals and lymphatics. The action of the lacteals and lymphatics is probably much the same, and is exerted in a similar manner. That of the lacteals is to convey the nourishing parts of the food into the circulating system; that of the lymphatics to carry to the same system watery fluids, for the purpose of diluting the blood, and such fluid or solid materials as are useless, or may prove noxious to the system. The action of the lacteals may be readily seen on opening an animal killed two or three hours after eating; and in this way they were first seen by Asellius. They are then found filled with a milky fluid, while, at other times, they are invisible. That the lymphatics are the principal organs of absorption, is now the general opinion of all physiologists, though their action in this way can seldom be demonstrated. As, however, it has been satisfactorily proved, that the veins do not generally absorb, and as the lymphatics that proceed from parts that contain irritating matters, are often seen inflamed, proving that they have imbibed a part of the irritating matter, there is little doubt that the office of absorption belongs almost exclusively to the action of the lymphatics.

187 By the veins. Mr John Hunter made several experiments to shew that the veins do not absorb. He conveyed milk, coloured with various dyeing substances, or perfumed with musk, into the small intestines of an ass, which was soon after killed. On opening the veins of the intestines, and allowing the blood to separate into serum and crassamentum, the serum was found neither to be tinged with the colouring matters, nor scented by the perfume, while the coloured milk was evident in the lacteals. That the veins, however, do in some cases perform the office of absorbents, is evident from the speedy depletion of the *corpora cavernosa penis*, after having been distended with arterious blood; and from a similar depletion that takes place in the nipple of the female breast.

188 By the skin. The principal object in dispute respecting the function of absorption in man and the higher classes of animals, is, whether the skin possesses the power of absorption. This question, as it is both curious and important, we shall examine pretty much at large; and for this purpose we shall avail ourselves of an able paper on the subject, by Dr George Kellie.

It had long been received as an established truth, that the skin was an inhaling or an absorbing organ, and that sometimes the inhalation balanced, or even surpassed, the exhalation of the cutaneous surface; but of late this doctrine of inhalation has been called in question, and, in the opinion of many, entirely overthrown. It has been said, that this absorption neither does nor can take place on the outside of the cuticle; that in every case of apparent absorption, the *epidermis* had been injured, or that the matter absorbed had been mechanically forced through it, and brought into immediate contact with the skin.

Haller had asserted *, on the authority of Dessault, that the body acquired an increase of weight in the warm bath; and this augmentation of weight was esteemed an *experimentum crucis* in favour of cutaneous absorption.

Experiments, however, have since been made with every necessary care, which seem to contradict the position, and to prove, that the body acquires no additional weight in the warm bath.

Seguin, from a great many experiments of this description, concludes, that there is no inhalation, because the body, so far from gaining, always lost some part of its weight during immersion, although much less than in the air in equal times †.

In other experiments again, as in those of Gerard and Currie, there was no increase of weight; but the body was

* *Elementa Physiologiæ*, tom. v. p. 88.

† *La Med. Eclairée.*

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is to be considered as a disease, depending on the inability of the stomach to propel the solid food into the duodenum.

Mr Home, in the paper we have already quoted, (N° 161—169), relates a curious instance of habitual rumination in a man 19 years of age, who is blind, and has been an idiot from his birth. He has a very ravenous appetite, and it is necessary to restrict him in the quantity of his food, since, if he eats too much, it disorders his bowels. Fluid food does not remain on his stomach, but comes up again. He swallows his dinner, which consists of a pound and a half of meat and vegetables in two minutes, and in about 15 minutes he begins to chew the cud. Mr Home was once present on this occasion. The morsel is brought up from the stomach with apparently a very slight effort, and the muscles of the throat are seen in action when it comes into the mouth; he chews it three or four times, and swallows it; there is then a pause, and another morsel is brought up. This process is continued for about half an hour, and he appears to be more quiet at that time than at any other. Whether the regurgitation of the food is voluntary or involuntary, cannot be ascertained, the man being too deficient in understanding, to give any information on the subject.

was not observed to have lost any thing during immersion in the warm bath.

Now, during these experiments, the body was doubtless wasting, by the pulmonary and cutaneous discharges, and yet the weight of the body either continued unchanged; or where a loss of weight was observed, this was constantly less, greatly less, than is experienced during the same interval in air. And we might be inclined to infer, from a truth so general, and so well ascertained, an argument in favour of absorption.

It might be argued, that the loss of weight amounts to little or nothing, because, during immersion, the body acquires more by inhalation than it does or can do in the air; that the loss by the pulmonary and cutaneous discharges are counterbalanced, or nearly counterbalanced, by the increased absorption.

Those, however, who deny absorption, will not allow us the advantage of this argument. They tell us, that the exhalation by the skin and lungs is diminished, which sufficiently explains why the body loses less in the warm bath than in air. But that the accustomed discharges are suppressed or diminished in the warm or tepid bath, is, we apprehend, far from being proved; and, till this proposition is made good, the argument against cutaneous inhalation cannot be securely maintained.

One of Dr Currie's cases deserves farther consideration. We allude to the case of dysphagia, published by this gentleman [*], in which Mr M. the subject of the case, was several times immersed in a warm bath of milk and water, and was weighed when taken out. Mr M. it is true, gained no weight while in the warm bath: but the loss continually going on in the air was, as in other trials, suspended during the immersions. Besides, he also expressed great comfort from the bath, with abatement of thirst; and, subsequent to the daily use of it, the urine flowed more plentifully, and became less pungent. An observation, precisely similar, is made by Mr Cruickshank. "A patient of mine (says Mr Cruickshank), with a stricture of the œsophagus, received nothing, either solid or liquid, into the stomach for two months; he was exceedingly thirsty, and complained of making no water. I ordered him the warm bath for an hour, evening and morning, for a month; his thirst vanished, and he made water in the same manner as when he used to drink by the mouth. (H) [†].

But to return to the case of Mr M——. Dr Currie himself remarks, that the discharge by urine alone exceeded much in weight the waste of his whole body; and it cannot be doubted that the discharge by stool and perspiration exceeded the weight of the clysters.—Thus it appears, that the *egestu* exceeded the *ingesta* in a proportion much greater than the waste of his body will explain. How is this accounted for, Dr Currie asks, unless by cutaneous absorption?

That the excess of these discharges above the *ingesta* and total waste, can be accounted for by absorption only, was indeed an irresistible conclusion. Still, however, cutaneous absorption is denied; and, when forced to confess that there are cases where the *egesta* exceed the *ingesta* in a much greater proportion than the waste of the body will explain, and which can only be accounted for by absorption, they refuse this function to the skin, and bestow it most liberally, and, in so far as we know, most gratuitously, on the lungs. We are not entitled, in return, to deny the reality of pulmonary absorption, but we may surely be allowed to urge, that there is no proof that the only inhaling organ is in the lungs; and there is none against the possibility of cutaneous absorption.

Is it not, on the other hand, proved, by the experiments of Seguin and Lavoisier, that the exhalation greatly exceeds the absorption by the pulmonary system? And if this is always the case, we cannot explain by pulmonary inhalation alone, why the *egesta* should, in some cases, exceed the *ingesta* in a much greater proportion than the waste of body will account for.

We now proceed to examine another class of experiments, much insisted on by those who deny cutaneous absorption; we mean those experiments performed by immersing a part of the body in solutions of active drugs, the absorption of which should be indicated by their usual effect on the system.

Seguin made numerous experiments of this kind with solutions of muriate of mercury (corrosive sublimate), on syphilitic patients. And we are informed, that in cases where the epidermis was perfectly sound, neither the known effects of mercury on the body, nor any amelioration of the venereal symptoms, was ever observed.

He also immersed his own arm in a solution of two drams of the mercurial muriate in ten pounds of water. At the temperature of 10° and 28° Reaumur, no part of the salt was missing at the end of the experiment; but when the bath was at 18° of the same scale there was a loss of one or two grains of the muriate in the hour, though the quantity of fluid was not diminished.

The explanation given by Seguin of this unexpected result is curiously ingenious, but embarrassed, and inconsistent.

At the temperature of 12°, he observes, the exhalants are in a state of contraction, and their orifices nearly closed. When the heat again is raised to 26°, the exhalation is so rapid, that nothing can enter the vessels from without; but at 18° of temperature, the orifices of the exhalants are sufficiently relaxed, and the exhalation at the same time so conveniently languid, that the solution rests quietly in contact with the matter of perspiration in the mouths of the exhalants, where it is somehow or other decomposed; a part of the salt leaving the water of solution, and combining with the perspirative matter, with which it is carried into the system [*]. Carried into the circulation by the exhalants! Is not this a plain acknowledgment of the reality of inhalation? But if in one case substances may thus be carried into the circulation, why not in many others?

Surely if the weight continues undiminished, in circumstances

[*] Medical Report, first edit. p. 227.

[†] Cruickshank on the Absorbents.

[*] Le Med. Eclairé, tom. iii. p. 238.

(H) That thirst may be allayed by immersion in water, is fully proved by the experience of shipwrecked mariners, who, when obliged to take to their boats with very little fresh water, frequently have recourse to bathing in the sea, or covering themselves with a shirt wetted in salt water, and thus quench their thirst, nearly as well as if they had drunk fresh water.

cumstances where the body is continually losing, we may infer, that something has been gained by absorption. And where the egesta exceed the ingesta in a proportion much greater than the waste of the body will explain, there absorption must have been going on.

The case of Mr M——, published by Dr Currie, is not singular. The writings of physicians abound in similar examples. They had often occurred to that excellent clinical practitioner De Haen, who was therefore persuaded that water was imbibed *. Haller too, with his usual industry, has collected a great many observations of the same kind †.

Again, when physicians were engaged in their extensive statical experiments, weighing themselves, their *ingesta* and *egesta*, for many months, nay for years together; they sometimes observed, that so far from losing, they had gained weight, especially during cold and moist weather. Thus, Rye, under a cold and humid atmosphere, gained 13 ounces. Linnings, during two hours exposed to cold, acquired 8½ ounces. The abbé Fontana, after two hours exposure to a moist atmosphere, returned home some ounces heavier than he went out. De Gorter gained 6 ounces in one night; and on other occasions, two ounces and four ounces. These observations are confirmed also by the experience of Dr Francis Home, professor of Materia Medica in the university of Edinburgh. 'Having fatigued myself pretty much (says he) in the afternoon, I went to bed without supper, and was so hungry that I could not fall asleep for some time. Betwixt eleven at night and seven next morning I had gained two ounces ‡.'

Here then are examples of the body gaining considerably more than the *ingesta* will account for, acquiring weight when neither food nor drink had been swallowed. And we have the concurring testimony of the most respectable writers supporting the same truth.

How can this increase of weight be accounted for, unless by absorption? In such experiments, the *loss of weight*, which cannot be accounted for by the sensible *egesta*, is attributed to the exhalation; the increased weight sometimes observed, and which cannot be explained by the sensible *ingesta*, must in like manner be referred to the *inhalation*.

That the system may be affected by active medicines introduced and absorbed by the skin, cannot be denied. And were proofs still wanting to establish the doctrine of cutaneous absorption, this argument might be insisted on. It is true, that friction is commonly employed when we wish to introduce medicines by the skin, by which, it is said, the substance is mechanically forced through the cuticle, and brought into contact with the absorbents of the true skin. The system, however, may be affected without friction, for example, by wearing a mercurial plaster, and more certainly by mercurial fumigation, as practised by Lalonette and others ‖.

It might even be concluded from an examination of the structure of the skin, that absorption must take place at its surface. We know that the cuticle is porous, and is penetrated by exhaling vessels; we know that lymphatics commence immediately below it; and we know that when certain substances are applied to the cuticle, especially when this application is aided by moderate friction, as in the case of applying garlic poultices to the feet, and the more familiar instances of mercurial inunction, that these substances are taken up by the absorbents, and conveyed into the circulation.

From a consideration of all these circumstances, we think it fully proved, that the skin is an absorbing or inhaling organ. For further proofs we may refer our readers to Bichat's *Anat. Gener.* tom. iv. p. 691.

189 Supposed retrograde action of the lymphatics.

Mr Charles Darwin, son of the late Dr Darwin, published in 1780, a Latin thesis, which is translated in the 29th sect. of his father's Zoonomia, vol. i. in which he attempts to prove, that the valves of the lymphatics are so formed as in particular cases to admit of the regurgitation of the absorbed fluids. The arguments on which he founds this opinion (beside the difficulty of accounting for the phenomena of several diseases on any other principle), are chiefly the following:

First, The mouths of the lymphatics seem to allow water to pass through them after death, the inverted way, more easily than in the natural direction.

Secondly, In some diseases, as diabetes and scrofula, it is probable the valves themselves are diseased, and are thence incapable of preventing the return of the fluids they should support.

Thirdly, There are valves in other parts of the body, analogous to those of the absorbent system, which are liable, when diseased, to regurgitate their contents.

Fourthly, The capillary vessels, which must be considered as analogous to absorbents, may be seen, in animals submitted to the microscope, to regurgitate their contents into the arteries, during the struggles of the dying animal.

By means of this hypothesis (for notwithstanding the arguments adduced in its favour, we can call it no better) Mr Darwin explained the speedy passage of watery fluids from the stomach to the urinary bladder; the phenomena of diabetes; diarrhœa, dropsy, cold sweats; translations of matter, chyle, milk, and urine; the operation of external remedies, &c.

190 Absorption in the lowest classes of animals.

In all those classes of animals that possess a complete absorbent system, the phenomena of absorption seem to proceed much in the same manner as in man; but in some of the inferior animals, especially in mollusca and worms, this function seems to be performed by the veins *. In the *echinodermata*, however, especially in the sea-urchin (*echinus esculentus*), lymphatics have been demonstrated by the second Monro. In insects and polypes there is no proper absorption.

191 Absorption of plants.

The absorbing vessels of plants are chiefly the fibrils of the roots, which evidently imbibe moisture, and perhaps gaseous fluids, from the earth; but there have also been demonstrated vessels opening beneath the outer bark, which botanical physiologists consider as lymphatics. "Lymphatic vessels (says Wildenow), are found in the epidermis of plants, and are of great minuteness, anastomosing in various ways through small intermediate branches." They surround the apertures of the cuticle, by which the inhalation and exhalation of vegetables are carried on; but they are so minute as not to have yet been filled with coloured liquids. Round each opening, which is commonly shut by a moveable valve, they form a circle, rarely a rhombus, as in the *zea mays*. In the *lilium calcedonicum*, those vessels run obliquely, and somewhat in an irregular undulating manner, fig. 2. In the common onion (*allium cepa*), they run in a straight, though oblique and regular form, fig. 3. In the pink, (*dianthus*

Plate CCCCXVIII.

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* Ratio Medendi, part iv. chap. 3.

† Elem. Physiol. tom. v. p. 90.

‡ Medical Tracts and Exper. p. 250.

‖ Edin. Med. and Surg. Jour. vol i. p. 181.

* Cuvier Leçons, tom. iv. p. 161.

(*dianthus caryophyllus*), they are very straight, with straight and horizontally transverse branches, fig. 4. In almost every plant they have their certain and peculiar direction, which in each remains constantly the same *.

192 Theory of absorption.

The theory of absorption is still but imperfectly understood. We shall briefly notice the principal hypotheses that have been brought forward to account for the entrance of substances into the mouths of the absorbing vessels; for this part of the process alone seems to be disputed.

It was long the opinion of physiologists, that fluids enter the mouths of the absorbents on the principle of capillary attraction; but as the absorbing vessels are not circumstanced like rigid capillary tubes, immersed in a fluid; and as, were this hypothesis just, absorption should go on with regularity, and all fluids should be absorbed indiscriminately, neither of which circumstances is true; this hypothesis is now generally abandoned.

Mr John Hunter accounted for the entrance of substances into the mouths of the absorbents, by attributing to the mouths of these vessels a power of nibbling, similar to that exerted by a caterpillar when feeding on a leaf. This opinion may be called ingenious, but is certainly very wild and fanciful.

Dr Fullarton, in a thesis on absorption, published at Glasgow in 1800, attributes to the absorbing orifices, a power of suction similar to that of the proboscis of butterflies, and the tentacula of some marine animals.

The first and third of these hypotheses suppose the absorbents incapable of taking up any but fluid substances; but we well know that even the hardest bones are somehow absorbed, and conveyed to the circulation. We must therefore add another hypothesis, which supposes that there is secreted in the animal body, a fluid capable of dissolving flesh and bones †. The hypothesis, however, is without foundation. It is contrary to the simplicity of the animal economy, that there should take place, first, a secretion of solid matters to compose the structure of the body, and then a second secretion to dissolve them. We must therefore consider this part of physiology as a subject of future investigation.

When the absorbed substances have once passed the barrier of the first valve, it is not difficult to account for their further progress through the lymphatics. A continual succession of fresh absorbed matter must drive forward what is already in the vessels, while the valves must in general prevent its reflux. The impelling force from behind is also probably assisted by the irritability of the vessels. It is not easy to decide how the absorbed matters pass through the glands: if, as is generally believed, they do not in these form continuous tubes, there must be a fresh absorption by the mouths of the vessels that pass out of the gland, which is as difficult to account for as the first reception at the origin of the vessels.

193 Relations of absorption with the preceding functions.

The relations that take place between absorption and the preceding functions, are perhaps the least understood of any that occur in the animal economy. We know that the action of the absorbents is greatly assisted by muscular motion, and that it is in general most defective in indolent and sedentary persons. An evident sympathy is also observed between the stomach and the absorbents. Nausea, and especially vomiting, are powerful promoters of absorption, and some remarkable instances are related of the speedy absorption of a large quantity of purulent matter from an abscess, in consequence of violent vomiting.

Chap. VII. *Of Circulation.*

194 Circulation.

We have traced the nutritious particles of the food from the intestines through the *lacteals*, the *mesenteric glands*, and the *thoracic duct*, into the left *subclavian vein*, where we find the chyle is mixed with the venous blood, and carried to the right auricle of the heart. We must now consider how the fluids are conveyed to every part of the body, or we must examine the function of *circulation*.

195 Organs.

This function takes place in all the vertebral animals, and in mollusca, worms, and crustacea; but there appears to be no real circulation in insects, zoophytes, and plants.

The organs by which circulation is performed differ essentially in the several classes of animals. Those of the human system have been described in the first part of ANATOMY, sect. x. and xi. and a brief comparative view of these organs in the inferior animals, has been given in the second part of that article, N° 154, 201—204, 300, &c. and in the articles CETOLOGY, ERPETOLOGY, ICHTHYOLOGY, and ORNITHOLOGY. For a fuller account of these latter, we may refer to Cuvier's *Leçons*, leç. xxiv. and xxv. and to the Comparative Anatomy of Blumenbach, chap. xii.

196 Pulmonic and systemic parts.

It is well known that, in the red-blooded animals, the blood is not of the same shade of red in every part of the body; but that what has passed through the lungs, and is circulating through the arteries that proceed from the aorta, is of a florid red colour, while that which is sent to the lungs by the pulmonary artery, as well as that which is returning from the extremities of the arteries through the veins, is of a purple or crimson colour. As one set of organs always contains florid, and another set always crimson blood, it is convenient to distinguish each set by an appropriate name. Dr Barclay has done this, and he calls that set of organs which are employed to convey the blood from the arteries, and distribute it to the lungs, *pulmonic*, comprising the *pulmonic veins*, viz. the vena cava and its branches, *pulmonic auricle*, *pulmonic ventricle*, and *pulmonic arteries*: while he denominates that set of organs which return the blood from the lungs, and distribute it to the system, *systemic*, comprehending the systemic veins (pulmonary veins), systemic auricle, systemic ventricle, and systemic arteries, (the aorta and its ramifications). One great advantage of this nomenclature, is that it prevents the ambiguity of the expressions *right* and *left*, *anterior* and *posterior*, applied to the auricles and ventricles of the heart. We shall therefore employ them in the subsequent part of this chapter *.

For an account of the nature and properties of the blood, see ANATOMY, Part I. sect. 14. and CHEMISTRY, N° 2642.

197 Proofs of the circulation of the blood.

It may not be improper, in this chapter, to notice the principal arguments that have been used to prove the circulation of the blood. They are as follow:

1. When the artery is tied, the part of the artery that is betwixt the ligament and the heart, swells; but that part of it which is betwixt the ligature and the remote branches, becomes more flaccid than before. On the other hand, when a vein is tied, the part between the li-

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* *Wildenow's Princ. of Bot.* sect. 236.

† *Duncan's Med. Com.* vol. x. p. 354.

* See Barclay on *Muscular Motions*, p. 231.

gature and the remote branches, swells, while the part between the ligature and the heart becomes flaccid.

2. The valves placed at the mouths of the aorta and pulmonary artery, must prevent the blood from regurgitating into the ventricles, while they permit it to flow forward through the arteries, into the capillary branches of the veins. Again, the valves situated in the course of the veins prevent the blood from flowing back into the arteries, while they permit it to proceed forward through the venous trunks into the heart.

3. By the assistance of a microscope, the blood may be seen in the pellucid parts of animals, as the feet of frogs, flowing from the arteries into the veins.

4. When an artery of moderate size is wounded, and not secured by ligature or compression in proper time, the blood flows out till the animal be dead.

5. Any thin liquid, when injected into an artery, does not pass backwards into the heart, but flows forward into the inosculating veins. On the other hand, such a liquid thrown into a vein, flows towards the heart, and not into the smaller branches of the vein.

The phenomena of circulation in the human body have been already mentioned under Anatomy, sect. xii. and xiii. and under Medicine, N° 95. We shall here only offer a compendious view of the course of the blood in the adult and in the fœtal state.

198
Circulation in the adult man.

I. After birth, the blood coming from every part of the body through the numerous ramifications of the vena cava, is poured into the right or pulmonic auricle of the heart, by the contraction of which it is thrown into the right or pulmonic ventricle, which contracting, throws it into the pulmonary artery, being prevented from regurgitating into the auricle by the action of the tricuspid valves. It is now, by means of the ramifications of the pulmonary artery, distributed through the lungs, from which it is brought back by four principal pulmonary veins, and poured into the left or systemic ventricle, which contracting with great force, propels it into the aorta, it being prevented from regurgitating into the auricle by the action of the mitral valves. The blood being propelled into the aorta, is by its trunks and branches, distributed to every part of the body, and brought back as before by the ramifications and trunks of the *vena cava.*

199
Circulation in the human fœtus.

II. In the fœtal state, the blood being brought back from every part of the body by the ramifications and trunks of the vena cava, is poured into the pulmonic auricle of the heart, where it is mixed with the blood brought from the placenta. A part of this blood is conveyed from the sinus of the auricle while in a state of dilatation, through the oval hole, into the systemic auricle; while another part, by the contraction of the auricle, is thrown into the pulmonic ventricle, which contracting, propels it into the root of the pulmonary artery. From this the greater part of the blood passes through the arterious canal, that in the fœtus joins the pulmonary artery to the aorta, in this latter; while the remainder is distributed by the ramifications of the pulmonary artery to the lungs, and brought back by the pulmonary veins to the systemic auricle of the heart. By the contraction of this auricle, the blood is thrown into the systemic ventricle, which contracting, propels it into the aorta. Now, while one part of the blood is distributed by the numerous ramifications of the aorta to every part of the body of the fœtus, another part is carried from the internal iliac arteries, through the two umbilical arteries, into the placenta, from which it is conveyed through the umbilical vein to the sinus of the liver. Hence, one part of the blood, without entering the liver, is transmitted by a branch of the umbilical vein, called *venous duct*, into the left branch of the *vena cava hepatica;* thence into the inferior great vena cava; while another part, by another branch of the umbilical vein, flows into the left branch of the *vena porta*, by the numerous ramifications of which it is distributed to the liver. From the liver it is carried by the *venæ cavæ hepaticæ* into the inferior great *vena cava*, whence it is conveyed, with the rest of the blood, to the pulmonic auricle of the heart, to be distributed as before.

200
Powers carrying on the circulation.

We must now briefly consider the powers by which the blood is made to circulate through such a multitude of vessels, so infinitely ramified, and differing so much in their diameter. It seems generally allowed at the present day, that these powers are chiefly the immediate muscular action of the heart, the action of the arteries, the valves of the veins, and the pressure produced on some of the veins by the action of the muscles that lie contiguous to them.

201
Action of the heart.

1. That the heart must possess very considerable force in propelling the blood through the arteries, may be supposed from the great muscularity of its ventricles; and this force has been proved by experiment and observation. From experiments made by Hales, viz. that of inserting a glass tube into a large artery, and measuring the height to which the blood ascends at each pulsation, it has been calculated, that the human carotid artery is capable of projecting its blood to a perpendicular height of seven feet and a half; and if we estimate the surface of the systemic ventricle at 15 square inches, we shall find that it sustains a pressure of 1350 cubic inches, equal to 51 pounds weight, which it has to overcome by its contracting force *. This is a moderate computation of the force of the heart, for Borelli estimates it at 180,000 pounds, while Keill diminishes it to eight ounces. Senac again, from having observed, that if a weight of 50 pounds be attached to the foot, with the knee of that side placed over the opposite knee, the weight will be raised at each pulsation, and allowing for the distance at which the weight is placed from the centre of motion, computes the force of the heart at 400 pounds † Blumenbach has seen the blood projected from the carotid of an adult more than five feet ‡ On a medium calculation, estimating the quantity of blood contained in the body at 30 pounds, the number of pulsations in each minute at 75, and the quantity of blood ejected from the systemic ventricle at each contraction at two ounces and a half, we shall find that the whole 30 pounds of blood will be carried through the whole body no less than 23 times in an hour, or the circulation will be completed in less than three minutes. From these circumstances we must infer that the impelling power of the heart is very great, and fully adequate to the office which it has to perform.

Various hypotheses have been formed to explain how the heart and arteries are excited to motion, but our limits will not permit us to detail them. Our readers will find them related at considerable length, and fully examined in the *Principes de Physiologie* of Dumas, tom.

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* *Hales's Statical Essays*, vol. ii.

† *Traité du Cœur.*

‡ *Institutiones Physiolog.*

iii. p. 332—364. The general opinion at present entertained on this subject is, that the heart is excited to action by the stimulus of the blood.

202 Action of the arteries.

2. Although it is more than probable that the action of the heart is the principal instrument in carrying on the circulation, there can be no doubt that the arteries contribute essentially to this office. They are evidently muscular, and are possessed of considerable irritability; are supplied with numerous nervous filaments, and are nourished by small arterial branches, commonly called *vasa vasorum*. Nay, we know that they are susceptible of contraction; for when we divide an artery in the living body, the divided extremities gradually contract, till, if the animal is not killed by the experiment, the aperture is at length obliterated *. Lastly, there have been instances of fœtuses without a heart; and as we must suppose that, during the life of the fœtus, the circulation was going on, it is a natural inference that this was chiefly effected by the contraction of the arteries, and not entirely by the impelling power of the circulating system of the mother.

203 Valvular structure of the veins.

3. It cannot be supposed that the veins have any immediate action on the blood, as they exhibit no circular fibres like the arteries, except in the immediate vicinity of the heart; but their valvular structure must contribute to the carrying on of the circulation, from the opposition it gives to the return of the blood, so that what is called the *vis à tergo*, or impelling power from behind, aided by the conical form of the veins, may have its full effect.

204 Action of the muscles.

4. That the action of the muscles has considerable influence in propelling the blood towards the heart, in those veins that lie in their neighbourhood, is evident from the effect that bodily exercise produces in accelerating the circulation, and from the efficacy of friction in removing congestions of blood in the veins of the extremities, and in the more familiar instance of promoting the swelling of the veins of the arm by the same means in the operation of bleeding.

205 Circulation of the inferior animals.

The circulation in those animals whose structure approaches to that of man, differs little from what is above described. There are indeed some peculiarities, a few of which we shall presently notice. An account of the circulation in the cetacea will be found in the article CETOLOGY, N° 140—145; that of the reptiles is described under ERPETOLOGY, p. 309.

206 Circulation of the mollusca;

The mollusca possess an evident and powerful circulation. Most of them have a simple heart, consisting of one auricle and one ventricle; and in these the vena cava performs the office of an artery, carrying the returning blood to the gills, whence it passes to the auricle, and is afterwards thrown into the aorta. There is a peculiarity in the cuttle fish, which has a heart consisting of three ventricles, without any part that can properly be called an auricle. Two of the ventricles are placed at the roots of the two bronchiæ, and have each a branch of the vena cava, by which they receive the blood from the body, and propel it into the bronchiæ. The returning veins open into the middle ventricle, and from this the aorta proceeds.

207 in the vermes;

Some of the vermes, as the leech, and the tribes of the *naias*, *nereis*, and *aphroditæ*, and some species of *lumbricus*, have no heart, but they have circulating vessels with evident contraction and dilatation.

208 in crustacea.

In the *crustacea*, the circulation is performed by a single ventricle, expelling the blood into the arteries of the body, and receiving it again after it has passed through the gills, in a manner very similar to the circulation of fishes.

209 Contracting and dilating tube in insects.

There is no circulation in insects; but these animals have running along the back a membranous tube, in which alternate contractions and dilatations are perceptible. This tube, however, is closed at both ends, and has no vessels proceeding from it.

210 No circulation in plants.

From the researches which evince circulation to be a function so general among animals, some are disposed to think it takes place in all living bodies. But notwithstanding the fashionable language of circulating fluids, of veins, arteries, and even of valves, in the vegetable structure; yet nothing performing the office of a heart, and nothing that seems to conduct fluids in a circular course, has been found in plants. In the vegetable kingdom, the chyle is distributed to all the parts, from the numerous vessels which convey the sap; and these vessels, being fitted by their structure to carry the sap either downwards or upwards, from the branches to the roots, or from the roots to the branches, is the reason why plants inverted in the ground will send forth roots from the place of their branches, and send forth branches from the place of their roots.

211 nor in some animals.

Even a similar distribution of the chyle takes place in some animals. In the human tænia, in the *fasciola hepatica* (fluke) of sheep, and in most polypes, the chyle, without a circulating system, is conveyed directly to the different parts from the alimentary canal.

For an account of the motion of sap in plants, see Darwin's *Phytologia*, a paper by Mr Knight in the *Philosophical Transactions* for 1801, Wildenow's *Principles of Botany*, sect. 276, and the article PLANT in this Encyclopædia.

212 Relations between circulation and sensation.

The relations that subsist between the function of circulation, and those which we have already considered, are very important. We shall begin with those of circulation and sensation. That the functions of the nervous system must be considerably influenced by the circulation of the blood, may be supposed *à priori*, from the large quantity of blood sent to the head, this being, on a moderate calculation, about one-tenth of the whole. A certain quantity of blood in the vessels of the brain seems essential to the due performance of the functions of that organ; and those animals, which, like man, have the blood sent in greatest quantity, and with greatest impulse, seem to possess the faculties of the brain in the greatest perfection, while those in whom the motions of the blood towards the head is much retarded, as in the sheep and cow, are remarkable for mildness and stupidity. When, however, the quantity of blood becomes too great, or its impetus too violent, the faculties of the brain are impaired, or altogether destroyed. No man, and very few other animals, can remain suspended with the head downwards for any long time, without dangerous, and commonly fatal consequences. The bat, indeed, is a remarkable exception to this rule, for this animal can hang by its hinder feet for days or weeks together, with perfect safety, a circumstance that may be accounted for from the very small quantity of blood contained in its circulating vessels. Again, the brain exerts an evident influence on the circulation. It is well known how much the action of the heart and arteries is quickened, impeded, or rendered irregular, by the passions of the mind. Cases are recorded in which these passions, carried to excess, have altogether stopped the circulation, and produced instant death. Fainting is often brought on by the sight of a disgusting or terrifying object, or by the odour of perfumes, or of substances to which the person has a particular antipathy. The sympathy between the heart and the nervous system is farther shown by the violent pain below the *sternum*, and sometimes in the arm, in cases of organic disease of the heart.

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* *Hunter on the Blood*, p. 114.

The circulation is even affected by intense thought; and we have heard of a bleeding from the nose being brought on by long and deep study, while the body was in a reclining posture, namely in bed.

213 Relations between circulation and motion

The functions of circulation and motion are intimately related. It is scarcely necessary to notice the acceleration of the pulse, in consequence of exercise and labour, or to remark that in indolent and sedentary people the circulation is generally slow and languid. In general, too, the blood circulates with most rapidity in those animals who are formed for quick motion, though the instance above quoted, of the bat, shows that the quickness of motion does not depend on the quantity of blood. Several curious anatomical facts have rendered it probable, that the production of quick or slow motion depends in a great measure on the mode in which the arterial branches are distributed to the moving organs. The arterial branches that supply the organs of voluntary motion, are divided in such a manner as to impede the motion of the blood towards these organs as little as possible: their ramifications are therefore few, and they go off from the trunk at very acute angles; whereas those that supply the viscera are at nearly right angles, are often tortuous, and are otherwise so constructed as frequently to impede the flow of blood. Physiologists have even explained the greater power that is generally found in the right arm, and the greater readiness with which most people use that arm, by the manner in which the right subclavian artery comes off from the aorta. This indeed we are disposed to consider as fanciful, and to attribute the more ready use of the right arm solely to habit and early instruction not to employ the left.

214 Distribution of the arteries in the limbs of slow moving animals.

In some animals that are remarkable for slowness of motion, as the *lemur tardigradus*, or slow lemur, and the *bradypus tridactylus*, or common sloth, there is a curious construction of the arteries that are distributed to the limbs of these slow-moving animals, which must have the effect of breaking the force, and impeding the velocity of the blood towards these limbs. In the *lemur tardigradus*, a specimen of which was dissected by Mr Carlisle, it was found that the *subclavian artery* and the *external iliac* were, soon after rising from the general trunk, divided into a great number of equal-sized cylinders surrounding the principal artery, now diminished to a very small size, and that each of these branches was sent to each of the principal muscles of the limbs, while the other arteries that supplied the other parts of the limbs were divided in the usual arborescent form. Struck with this appearance, Dr Shaw and Mr Carlisle afterwards examined several specimens of the sloth, and found a similar conformation, while in other species of bradypus, not remarkable for slow motion, no such appearance took place*. Fig. 5 & 6. Plate CCCCXVIII. represent the division of the arteries in the slow lemur above described.

215 Relations of circulation with digestion.

The relations between the circulating and digestive organs are proved by the sudden acceleration of the pulse from stimuli received into the stomach; from the diminished circulation or sudden cessation of the heart's motion from powerful sedatives received into the same organ, especially the *prunus lauro-cerasus*; from the irregularity produced in the circulation in consequence of *dyspepsia*, and many other considerations.

216 Relation of circulation and absorption.

That there is an intimate relation between circulation and absorption, cannot be doubted, though the nature and effects of this relation are not yet well understood. We know that the vessels sympathize with the absorbents in their activity or languor; that when the absorbents are languid in their action, the blood-vessels, especially the exhalants, are in a feeble or relaxed state, and that the absorbents are often roused to greater action by remedies that first act on the circulation.

217 Action of the vessels on the blood.

Numerous experiments have shown how much the colour and consistence of the blood are altered by the mere action of the vessels; and this discovery has enabled us to conjecture with more probability than we did formerly, why in infants and phlegmatic persons the blood is paler, in the choleric more yellow, and in the sanguine of vermilion red. It explains likewise in some measure, why the blood varies in the same individual not only with regard to the state of health, but likewise at the same instant; and why the blood which circulates through the veins has not the same intensity of colour, nor the same consistence, as that of the arteries; and why the blood which flows through the organs of the breast differs from that which passes languidly through the viscera of the lower belly. This power of the vessels over the blood will bring us also to the true cause why the vessels vary in the density of their coats and in their diameters; why they are sometimes convoluted in a gland, and why they sometimes deposit their contents in a follicle; why they are sometimes of a spiral form; why the branches strike off at various angles; why they are variously anastomosed; why they sometimes carry the blood with dispatch, and sometimes slowly through a thousand windings. By these means their action is varied, and the blood prepared numerous ways to answer the ends of nutrition and secretion.

On the varieties of the *pulse*, and the morbid affections of circulation, see MEDICINE, N° 96—104.

CHAP. VIII. *Of Respiration.*

218 Necessity of respiration.

WHILE the fluids are passing through the body, by what is called the *greater circulation*, they give out certain parts or principles, partly for the purpose of nutrition, and partly to free the system from noxious matters. In order to regain some of the principles which they have lost, it is necessary that they should be exposed to the influence of atmospheric air; for which purpose they are made to pass through appropriate organs, which, as we have already observed, are in general either lungs or gills. The action by which the fluids and the air are made to act on each other, is called *respiration*, and consists of two kinds, *inspiration*, by which the air is received into the body, and *expiration*, by which it is again thrown out.

So essential is respiration to the system, that snails, chameleons, and some other animals, can live for years, without any apparent nourishment, provided they be not excluded from air. We have seen a chameleon that lived, and was vigorous, for 22 months, without any food, and which might have continued to live much longer, but for an unfortunate bruise by a fall.

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* *Shaw's General Zoology*, vol. i.

Other phenomena equally demonstrate the importance of air to the living body. The frog leaps away wanting its heart; it survives the loss of the greatest part of its spinal marrow; without its head, it lives for some days, and its heart continues to circulate its blood. Borelli found, that eels and serpents, though their bodies be opened, and the whole of their bowels be taken out, are able to move for a day after, and yet, in all these animals, the life is observed to be suddenly extinguished when the all-vivifying air is excluded. Even the smallest insect has died, and the plant lost its vegetative power, when retained for any considerable time in a vacuum. Fishes themselves, when placed under an exhausted receiver, have started anxiously to the surface of the water in quest of fresh air; and finding none, have sunk to the bottom and expired in convulsions. It will presently appear that this necessity of air to life is general in all the classes of organized beings (K).

219 Organs. The organs of respiration belonging to the human system, viz. the *larynx*, windpipe, lungs, diaphragm, ribs, and numerous muscles, have been sufficiently described in various parts of the article ANATOMY; and some account of these organs in the inferior animals has been given in the second part of that article, N° 155, 156, 206, 208, 271—274, and in the articles CETOLOGY, ERPETOLOGY, and ICHTHYOLOGY. For a more complete account of the respiratory organs in the inferior animals, the reader is referred to Cuvier's *Leçons d'Anatomie Comparée*, Leç. xxvi. et xxvii. and to Blumenbach's *Comparative Anatomy*, chap. xiv. and xv.

220 In examining the function of respiration in warm-blooded animals, two circumstances are principally to be considered; the mechanism of respiration, or the mechanical means by which the organs are enabled to receive and expel the air, and the effects produced by respiration on the circulating fluids, and on the system at large. Our principal object in this article is briefly to explain the mechanism of respiration; to notice the effects produced on the air by the respiration of different animals, with the effects produced on them, and the relations that take place between respiration and the preceding functions of sensation, motion, digestion, and circulation.

221 Mechanism of respiration in man. In order to make an inspiration, the intercostal muscles, and the muscular fibres of the diaphragm, are thrown into contraction, while at the same time the abdominal muscles, and the muscular fibres of the windpipe, are relaxed. By these means the diaphragm being drawn towards the *sacrum*, and rendered less convex towards the chest, and the ribs being drawn upwards (or forwards in quadrupeds), the cavity of the chest is enlarged, and the air remaining in the lungs being rarefied, the external air rushes in through the windpipe by its own gravity, and distends the lungs. In making what is called a very deep inspiration, other muscles that are connected with the atlantal ribs, viz. those called *scaleni*, *trapezii*, *cervicales descendentes*, *serrati superiores*, and pectoral muscles, assist to elevate the ribs more than in an ordinary inspiration. By the action of the intercostal muscles the ribs are drawn *atlantad* (upwards in man, and forwards in quadrupeds), because the most atlantal rib on each side of the thorax is fixed, and therefore all the other ribs are drawn towards it; and they are also drawn peripherad (outwards), because their greater curvature is in the direction of the *sacrum*, and because they turn on their vertebral extremities as on a fulcrum.

In order to make an expiration, the abdominal muscles, and the muscular fibres of the windpipe, are contracted, while the intercostal muscles, and the muscular fibres of the diaphragm are at the same time relaxed. By these means, aided by the elasticity of the cartilages of the ribs, and perhaps of the mediastinum, the ribs are drawn sacred (towards the sacrum), while the diaphragm, partly by its own muscular action, and partly in consequence of the pressure of the bowels, is rendered convex towards the chest. Thus, this cavity is considerably diminished, the lungs are compressed, and part of the air is expelled through the windpipe. In making a strong expiration, little more is necessary than a more powerful contraction of the abdominal muscles.

222 In other animals. The mechanism of respiration in mammalia is so similar to that of man, that we need not enter into it; that of *cetacea* has been sufficiently explained under CETOLOGY, N° 146—151; that of birds may be gathered from what has been said on their structure, in the comparative part of ANATOMY, N° 271, and in ORNITHOLOGY, N° 37; that of reptiles has been fully explained under ERPETOLOGY, page 311; and that of fishes under ICHTHYOLOGY, page 73. The mechanism of this function in the classes of animals below these is so simple, that a consideration of it is unnecessary. In insects the air enters the numerous ramifications of the *tracheæ*; is carried by them into every part of the body, and is then returned by the same passages. In some of the mollusca, respiration proceeds in a similar manner, by the ramifications of the pulmonary vessels that enter by the neck; but in most of these, and in all the lowest tribes, such as worms and zoophytes, respiration seems to be carried on entirely by the pores of the skin.

223 Quantity of air received and emitted. Many attempts have been made to ascertain the quantity of air received and emitted in a single inspiration or expiration. See CHEMISTRY, N° 2535. This point is not yet fully ascertained, but we may probably estimate the quantity expelled by each ordinary expiration at one-seventh part of the whole contents of the lungs, and that of the most violent expiration at about four-sevenths

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(K) It was long ago observed by Pliny, that if the bodies of insects are besmeared with oil, they soon perish: "*oleo illito insecta omnia exanimantur*." The same observation was afterwards made by Ray, who explained it by showing that in this way the pores through which the animals breath are stopped. Mayow also found, that if the oil be applied only to some of these pores, the neighbouring parts become paralytic, while the rest of the body continued sound. See Ray's *Wisdom of God*, and Mayow's *Tractatus*.

sevenths of that quantity; or that the medium quantity of air consumed during a common inspiration or expiration is about 40 inches *.

224
Ordinary number of respirations in a minute.

Another circumstance respecting the mechanism of respiration merits notice, viz. the ordinary number of respirations made in a minute by a healthy person. This varies considerably in different subjects, being in general greatest in children, and least in old persons. Dr Hales estimated the number of 20 in a minute; the subject of Dr Menzies' experiments respired only 14 times in the same period, while Mr Davy reckons his respirations at between 26 and 27; the subject of the experiments made by Messrs Allen and Pepys, breathed about 19 times in a minute, and with this Dr Thomson's experience agrees. The average of all these is about 20, which we may probably consider as a tolerably just estimate. Much, however, will depend on the circumstances in which the person is placed; on his habits of activity or indolence, of temperance or intemperance; on the state of the atmosphere, &c.

225
Experimental writers on respiration.

The chemical changes produced on the air by the respiration of animals have been described, so far as they were then known, under CHEMISTRY, N° 2536. Since that article was written, however, several valuable observations have been published, and the most important of these must be here noticed; but as we cannot, in this place, give any thing more than a summary sketch of these observations, we shall here enumerate the principal works that have appeared on this experimental part of our subject. The chemical physiologists who have been most conspicuous in these researches are, Mayow (in his *Tractatus de Respiratione*, or the *Analysis* of his works by Beddoes); Priestley (*Experiments and Observations on Air*); Lavoisier (*Traité Elementaire de Chimie*, *Physical and Chemical Essays*, and a work on *Atmospheric Air*); Goodwyn (*On the Connection of Life with Respiration*); Coleman (*On Suspended Respiration*); Menzies (*On Respiration*); Spallanzani (*Memoires sur la Respiration*), translated into French by Senebier, and since into English, and *Rapports de l'Air avec les Etres Organisés*, &c. also collected by Senebier); Davy (*Researches Philosophical and Chemical, into the Nature of Nitrous Oxide*); Ellis (*Inquiry into the Effects produced on Atmospheric Air by Respiration*), and Allen and Pepys (*Philosophical Transactions*, 1808, Part II. or *Phil. Mag.* vol. xxxii.). Most of the facts observed by these experimentalists, except those of the three last mentioned, have been collected by Dr Bostock, in his *Essay on Respiration*, by Dr Thomson in his *System of Chemistry*, vol. v. third edition, and by Mr Johnson in his *Animal Chemistry*, vol. iii.

226
Ascertained changes on respired air.

The following changes produced on air that has been respired by warm-blooded animals, seem to have been fully ascertained; viz. 1. That the respired air generally suffers a sensible diminution of bulk; 2. That it loses a part of its oxygenous portion; 3. that it acquires an additional quantity of carbonic acid gas; 4. That it is charged with watery vapour. We shall resume these facts, and consider the additional information which has been acquired respecting them since the publication of our article CHEMISTRY.

227
Its volume sensibly diminished.

1. *Atmospheric air generally suffers, by the respiration of warm-blooded animals, a sensible diminution in its bulk.*—The results of the experiments made by different chemists on the diminished volume of respired air, are exceedingly various. Mr Davy makes the diminution amount to one-eighteenth † of the whole air inspired; Lavoisier and Goodwyn estimate it at no more than one-sixtieth ‡, and Dr Bostock so low as one-eightieth ||, while Crawford and some later experimentalists could perceive no diminution. Dr Thomson states the results of his experiments upon this subject to be, that in some cases he could perceive no diminution at all, while in others it was perceptible. It was greatest when the animal was taken out repeatedly during the experiment, or when he employed air purer than that of the atmosphere. He is disposed to consider the diminution as accidental, and as owing to some absorption of air, altogether independent of respiration, and exceedingly various in different circumstances §. In the experiments of Messieurs Allen and Pepys, the general average of the deficiency in the total amount of common air inspired, appeared to be very small, amounting to about six parts in 1000, and they are inclined to attribute it, in a great measure, to the difficulty of exhausting the lungs so completely after an experiment as before it *.

228
Part of its oxygen abstracted.

2. *Atmospheric air, by the respiration of warm-blooded animals, loses a part of its oxygen.*—From a comparison of the experiments of Mr Davy, with those made by Lavoisier just before his death, Dr Thomson estimates the quantity of oxygen consumed in a minute, by respiration, at 31.6 cubic inches, making in 24 hours 45,504 cubic inches; and he concludes that in a day a man consumes rather more than 25 cubic feet of oxygen, and that he renders unfit in the same time for supporting combustion and respiration, no less than 125 cubic feet of air †.

229
Carbonic acid gas acquired.

3. *Atmospheric air acquires, by respiration, an additional quantity of carbonic acid gas.*—The opinion of Dr Menzies, that the bulk of carbonic acid gas produced by respiration, is precisely equal to that of the oxygen lost, appears now to be fully confirmed. In Mr Davy's experiments they corresponded very nearly ‡, and in those of Mr Dalton and Dr Thomson, they corresponded exactly. The latter chemist found, on the whole, that the bulk of oxygen which disappeared was somewhat greater than that of the carbonic acid generated; but the difference varied considerably, and kept pace with the diminution of the bulk of air respired. Hence he considers it as owing to the abstraction of part of the air by some other way than respiration, and allowing for this abstraction, he has no doubt that the bulk of the carbonic acid formed is precisely equal to that of the oxygen that has disappeared. He is disposed to consider the absolute quantity of carbonic acid generated in 24 hours, as something less than 40,000 cubic inches on an average §. The following results of the experiments made by Messieurs Allen and Pepys, as these were made on a large scale, may be considered as quite satisfactory on this head. 1. It appears that the quantity of carbonic acid gas emitted is exactly equal, bulk for bulk, to the oxygen consumed. 2. Atmospheric air once entering the lungs, returns charged with from 8 to 8.5 per cent. carbonic acid gas, and when the contacts are repeated almost as frequently as possible, only 10 per cent is emitted. When the inspirations and expirations are more rapid than usual, a larger quantity of carbonic acid is emitted in a given time; but the proportion is nearly the same, or about

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* Bostock on Respiration, p. 35.

† Researches, p. 435.

‡ Bostock on Respiration, p. 87.

|| Ib. p. 99.

§ System of Chem. third edit. vol. v. p. 735.

* Philos. Mag. vol. xxxii.

† System of Chemistry, vol. v. p. 736.

‡ Researches, p. 431.

§ System Chem. vol. v. p. 737.

eight per cent. The proportions of carbonic acid gas, in the first and last portions of a deep inspiration, differ as widely as from 3.5 to 9.5 per cent. 3. It appears that a middle-sized man, aged about 38 years, and whose pulse is 70 on an average, gives off 302 cubic inches of carbonic acid gas from his lungs in 11 minutes; and supposing the production uniform for 24 hours, the total quantity in that period would be 39534 cubic inches (*agreeing almost exactly with Dr Thomson's estimate*), weighing 18,683 grains, the carbone in which is 5363 grains, or rather more than 11 ounces troy; the oxygen consumed in the same time will be equal in volume to the carbonic acid gas; but it is evident, that the quantity of carbonic acid gas emitted in a given time, must depend very much upon the circumstances under which respiration is performed; and here it may be proper to notice, that all these experiments were made between breakfast and dinner. 4. A larger proportion of carbonic acid gas is formed by the human subject, from oxygen than from atmospheric air *.

230
Watery vapour required.

4. *Atmospheric air returns from the lungs charged with aqueous vapour.*—Of this circumstance there is no doubt, but the quantity of water contained in the expired air, and the sources from which it is derived, are still in dispute. Dr Thomson estimates the former at about 19 ounces per day; but he does not lay much stress on the results of his own experiments, as they were not sufficietly varied to give a fair average. As to the sources of this watery vapour, it has been generally supposed, that the water is formed in the lungs by a combination of part of the oxygen consumed with hydrogen evolved from the venous blood. This, however, is mere hypothesis. It has not been proved that hydrogen is evolved from the blood; and as the quantity of oxygen consumed appears to be taken up in forming the carbonic acid gas that is expired, there is none left to form water. No hydrogen, or any other gas, except carbonic acid and azotic gas, appear to be evolved during the process of respiration †.

231
Is azote lost?

There is another change supposed by most chemical physiologists, to be produced on the air by respiration, namely the loss of part of its azote; but this is still disputed. Dr Bostock concludes it to be probable, that a small portion of azote is lost, which he estimates on an average at $\frac{1}{180}$ of the air respired, making in 24 hours, about 4.5 ounces, or four cubic feet ‡. Mr Davy found the consumption of azote to amount to about one seventh of that of oxygen ‖; and some late experiments of Dr Henderson afford a similar result, though in these the proportion is rather less §. Dr Thomson also found a loss of azote, but it was extremely inconstant, sometimes being scarcely perceptible, at others considerable. It kept pace with the diminution of the bulk of the air respired, and with the difference between the bulk of the oxygen consumed, and the carbonic acid formed. He conceives that a portion of the air respired disappears without undergoing any change, and that this portion occasions the diminution of the azote, and the difference between the bulk of the carbonic acid formed, and that of the oxygen consumed. He thinks it conceivable, that the disappearing of such a portion may be confined to the unnatural circumstances occasioned by the experiment; that the difficulty of throwing out the air from the lungs in these circumstances, may be such as to induce absorbents to act, and remove a portion which in the ordinary state of the lungs would have been thrown out by expiration *.

232
Changes on the air by the respiration of the inferior animals.

Experiments on the changes produced on atmospheric air and oxygenous gas, by the respiration of the inferior animals, have been made chiefly by Vauquelin, Spallanzani, and Mr Davy, and some of them have been repeated and varied by Mr D. Ellis. From all these experiments we find, that by the respiration of amphibia, of fishes, of insects, of mollusca, and of worms, the air in which they have been confined suffers changes analogous to those produced in it by the respiration of the warm-blooded animals; that the oxygenous part is diminished, and that this diminution is most complete when insects and worms have been confined in it; that carbonic acid gas is in all cases produced, but that the quantity produced varies in different animals; that fishes live for the shortest time, and amphibia and worms for the longest, when confined in a certain quantity.

From the latest experiments made by Spallanzani, on the effects both of living and dead animals, on atmospheric air, as collected by Senebier, that experimentalist has drawn the following conclusions. 1. In beginning with worms, and rising up to man, there is no species of animal which does not destroy the oxygen of the atmosphere after death, and destroy it entirely if it be kept inclosed in it, provided the quantity be not too great in proportion to the size of the animal; because a considerable time is required when the volume of air is large, and a less time when the quantity is small.

2. This destruction of oxygen by dead animals, is under similar circumstances slower than that effected by living animals; if we regard merely the effects produced by the cutaneous organ, independent of the action of the lungs.

3. He thought he had legitimately proved, that the destruction of oxygen by the cutaneous organ, is not occasioned by the combination of this gas with the carbone of the animal; but that it is a true absorption of that element, by the body of the animal deprived of life. It does not give out carbone, but carbonic acid, as he believed he had proved by unanswerable experiments.

4. The absorption of oxygen by animals cut into small pieces, is greater than that occasioned by animals entire in similar circumstances.

5. A cold-blooded animal of the same bulk, and in the same circumstances as a warm blooded animal, absorbs more oxygen than the latter after death.

6. The skin is not the only part of an animal which absorbs oxygen; all the parts, solid, fluid, and soft, not excepting the driest horny parts, as the nails of quadrupeds, the bill and feet of birds, produce the same effect †.

233
Effects of vegetation on the air.

It has long been known that plants would not vegetate, if excluded from atmospheric air. Papin confined an entire plant in the exhausted receiver of an air-pump, and it soon perished; but on keeping a similar plant in this vacuum, with only its leaves exposed to the air, it continued to live for a long time ‡. When the leaves of a plant are stript off, or blighted by insects; when they have the upper surface smeared with oil, with varnish, or laid upon water §, the plant dies in a few days. Hence it is evident that the leaves of a plant are necessary organs, and that there is produced on the air in which the plant vegetates, some change essential to the healthy action of the plant. What this change is, has not been fully ascertained. It is the general opinion, that the leaves absorb a portion of the atmosphere, and give out certain gaseous products; and it is generally believed, that most plants have the property of giving out oxygenous gas during their exposure to the light, and azotic gas or some other irrespirable air in the dark. That oxygenous gas is necessary to vegetation, is fully proved; and it seems certain, especially from the experiments of Mr Ellis, that under the ordinary circumstances, carbonic acid gas is generated during their vegetation *. Mr Ellis, who is not satisfied with the accuracy of the experiments of Scheele and Priestley, seems to doubt whether plants at any time give out oxygenous gas; and thinks that the principal use of oxygen to them, is to combine with the superfluous carbone produced by vegetation, and thus form the carbonic acid evolved.

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* *Phil. Mag.* vol. xxxii. p. 165.

† *Phil. Mag.* xxxii. p. 265.

‡ *Essays on Respiration*, p 100.

‖ *Researches*, p. 33.

§ *Nichols Jour.* 8vo. vol. viii. p. 44.

* *Syst. Chem.* vol. v. p. 738.

† *Edin. Med. Jour.* vol. v. p. 109.

‡ *Darwin's Phytologia*, p. 51.

§ *Ellis's Inquiry*, p. 18.

234
Effects of respiration on the animal system.

Having considered the effects produced on the air by the respiration of animals, and the vegetation of plants, we must now notice the effects produced by the exercise of the same function on the animal body, as the comparison of these effects with the changes produced on the air itself, affords us the only clue to a rational theory of respiration.

235
Changes on the blood.

We have already stated (CHEMISTRY, 2540), that during respiration, the blood changes from the dark colour which it has in the veins, to the bright scarlet of arterial blood. It has been found, that a clot of venous blood, when out of the body, assumes the bright tinge, when exposed to the action of oxygenous gas; and that venous blood confined within a bladder, undergoes a similar change, when the bladder is immersed in oxygenous gas. It has been also found, that when arterial blood out of the body is exposed to the action of irrespirable gases, it loses its bright colour, and assumes the purple hue of venous blood.

236
Increase of temperature.

It is fully ascertained, that the heat of the body is chiefly kept up by respiration. See CHEMISTRY, N° 2545.

237
Theory of respiration.

Let us now consider the most probable theories of respiration, chiefly as they are applicable to the human system. Without staying to notice the older hypotheses that have been advanced to explain this function, we shall only state the present most received doctrine, and mention the objections that have been lately made to it.

238
Theory of Allen and Bostock.

This doctrine is stated in the following manner by Dr Bostock, one of its most strenuous defenders. "The blood arises at the right side of the heart, in a venalized state, loaded with a quantity of the oxyde of carbone; as it passes through the pulmonary vessels, it becomes subjected to the action of the air contained in the bronchial cells; a portion of the oxygen is removed from the air, part of which, forming an intimate union with the oxyde of carbone, is expelled in the form of carbonic acid gas, while the remainder is dissolved in the blood." It is here necessary to remark, that it is not *oxygenous gas*, but *oxygen*, which is supposed to be mixed with the blood. The caloric thus set at liberty is employed, part of it in maintaining the temperature of the lungs, which would otherwise be cooled by the admission of the external air; part of it in carrying off the aqueous vapour, and another portion in converting the carbonic acid into carbonic acid gas; but the greatest part of it is united, in the form of specific heat, to the arterial blood, which, by becoming arterialized, has its capacity for heat increased. The arterial blood is poured into the left cavity of the heart, and propelled through the arteries into the extreme parts of the body. The oxygen which was dissolved in the whole mass of blood, during the circulation, gradually unites itself more intimately to a portion of the carbone in it, which it converts into the oxide of carbone, and thus the blood acquires the venous state. By this change, its capacity for caloric is diminished; the specific heat which it obtained in the lungs, is given out in the capillary vessels, to keep up the temperature of the body, and the blood returns to the right side of the heart completely venalized. This hypothesis is nearly similar to the one which was proposed by M. M. La Grange and Hassenfratz; it received some modifications from Mr Allen of Edinburgh, and was delivered by him nearly in the form which I have stated above, in his admirable course of physiological lectures. It was, I believe, first published in my Essay on Respiration *."

This doctrine, if sufficiently established, would explain the manner in which the blood becomes arterialized in the course of the lesser circulation. It would also shew how, under particular circumstances, the arterial blood may be venalized without leaving the arteries, and the venous blood arterialized without leaving the veins. It accounts for the gradual evolution of caloric in the capillary vessels, during the course of the circulation, by the union which takes place between the oxygen and the carbone; whereas in the other hypothesis, (see N° 241.;) this union is entirely completed in the lungs. It would allow a considerable time in which this union might be accomplished, and would likewise suppose the constituent parts to remain in perfect contact for an indefinite period. This hypothesis would also explain how the oxygen is disposed of, which is supposed not to be concerned in the formation of carbonic acid, and would likewise possess the advantage of supposing the existence of a surplus quantity of oxygen, which being carried along the circulation, might be expended in a variety of useful purposes in the different parts of the animal economy. It would shew how the supply of matter which is poured into the blood by the absorbents, is gradually incorporated with the mass; and after the separation of that portion, which is necessary for repairing the waste of the different organs, the remainder is united to oxygen, and keeps up the temperature of the body; and, having afterwards no farther useful purpose to serve, it is discharged by the lungs †.

239
Objections.

Several objections, however, may be made to this theory. It is not proved that there is in natural respiration any absorption of oxygen by the blood; for though much of the oxygenous portion of the atmosphere is lost, the quantity of carbonic acid generated is sufficient to account for it. Mr Ellis has lately made very strong objections to this supposed absorption of oxygen, drawn chiefly from the anatomical structure of the blood vessels, and of the bronchial cells. He contends that the coats of the former, and the membranes bounding the latter, can scarcely admit the passage of air through them, much less that of the solid basis of oxygenous gas, which basis Dr Bostock supposes to be the principle absorbed. It is still more improbable, according to Mr Ellis, that two solid bases, namely those of oxygenous gas, and of oxide of carbone, should be at the same time passing through these resisting membranes; a supposition that is necessary in the hypothesis just stated. Again, supposing that this absorption of oxygen should take place, from the affinity of the blood for this principle, it is not easy to conceive why this affinity should so soon cease, and why the blood should again part with the oxygen, to the base of carbonic oxide ‡. These objections are certainly very forcible; let us see how they have been answered.

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* *Ellis's Inquiry*, p. 39. et seq.

* *Edin. Med. Jour.* vol. iv. p. 160.

† *Ib.* p. 167.

‡ *Ellis's Inquiry*, p. 117.—123.

240 answered.

Dr Bostock, in an ingenious reply to Mr Ellis's objections, in invalidation of the first objection, quotes the well known experiment of Dr Priestley, mentioned in N° 235. that venous blood becomes changed when exposed to oxygenous gas, even though a bladder be interposed between them; and in controverting of the rest, he seems chiefly to rely on the supposition that a greater quantity of oxygen is consumed than is taken up in the formation of the carbonic acid. He also does not consider it as *necessary* to suppose that either the oxygenous gas, or the oxygen itself, should enter the blood vessels, and should afterwards be expelled from them; but only that a *part of the oxygen* should be *attracted* by the blood, and after entering into a variety of new combinations, should be discharged as a constituent of some of these new compounds. Without inquiring in what way the action between the blood and oxygen takes place; whether it be in consequence of the mechanical structure of the membranes, which permits the oxygen to pass through their pores, or whether it be owing to the affinity of the blood for oxygen, which causes it as it were to become saturated with this substance before it transmits it; it appears to him sufficient to state, that oxygen and blood can act on each other, through a membrane which is very much thicker, and probably much denser, than that which separates the blood in the lungs from the air in the bronchial cells*.

* *Edin. Med. Jour.* vol. iv. p. 161. *et seq.*

241 Mr Ellis's opinion.

From a consideration of the principal experiments on respiration that have been made by the ablest chemical physiologists, and a comparison of these with what he has himself made, Mr Ellis contends that no part of the air enters into the blood, but all the oxygen which disappears is to be found in the carbonic acid produced; and that this carbonic acid is formed by the union of carbone emitted by the exhalant vessels of the lungs, uniting with part of the oxygenous portion of the inspired air †.

† *Edin. Med. Jour.* vol. iv. p. 327.

242 Objections.

To this opinion Dr Bostock, in the paper already referred to, makes the following objections; that this opinion does not explain how the regular supply of carbone is, at each successive circulation, brought to the lungs in a state proper to be discharged; and that it does not explain in what way the oxygen is employed, which is consumed in respiration ‡.

‡ *Edin. Jour.* vol. iv. p. 163.

243 answered.

To the first of these objections (which, if it be proved that the whole of the oxygen is taken up in forming carbonic acid, is the only objection that can properly lie against his opinion), Mr Ellis replies, that the supply of carbone is derived from the digestive organs; but he does not conceive, as Dr Bostock seems to imagine, that this is no sooner received into the blood than excreted, or that the first operation which takes place in the sanguiferous system after it has received the substance which is to afford nutriment to the body, is to discharge the greatest part of it. He regards carbone as a constituent part of the animal fluids, and he has endeavoured to shew, that it is emitted by the exhalants of the skin and intestines, as well as by those of the lungs, producing in all cases similar changes on the air. Digestion he holds to be in no other way the source of the carbone in these fluids, than as it is the source of all the other principles which they contain. We know that all the phenomena of respiration are often exhibited for long periods where no digestive process is carried on; but the functions of life must sooner or later come to an end, if the various means of exhaustion be not recruited by supplies through the digestive organs. It is only in this distant view that he considers digestion as the source of carbone; its immediate sources are the exhalant functions of the body, which will afford carbone as long as they are supported by the motion of the blood, and will no longer yield it when the motion of the blood has ceased. But whether the exhalant functions continue or cease, he considers that carbone exists abundantly, if not equally, in the serum and crassamentum, in arterial and venal blood *.

* *Edin. Jour.* vol. iv. p 327.

244 Theory of respiration still incomplete.

On the whole, though the final causes of respiration, or the uses to which it is subservient in the animal economy, are now pretty well understood, we must acknowledge that the mode in which these beneficial effects are produced, has not yet been satisfactorily explained.

245 Uses of respiration.

The principal uses of respiration appear to be, 1. To bring about some beneficial change in the fluids of the body, and through them on the solids; 2. To preserve the equable temperature of the body; and, 3. In all those animals that breathe by lungs to produce those sounds which arise from what we call *voice*.

246 Animal heat.

That animal heat is kept up chiefly by respiration, requires we think, no particular proof. It is well known, that those animals which consume most air during respiration, have the highest temperature. Birds in particular have the most extensive breathing organs, and the temperature of these animals is higher than that of any other class. The respiration of reptiles, fishes, and most of the lower classes, is slow and languid, and the temperature of these animals is proportionally low. The heat of each species is, however, pretty uniform under ordinary circumstances. That of the human body is generally about 98° of Fahrenheit. This however depends on the circumstances in which it is placed. When much chilled by the action of cold, the temperature of the human body falls a degree or two below the ordinary height; and under the influence of violent fever, it rises several degrees above it. The temperature is generally highest in children; and instances are recorded of these having survived, while their mothers, to whose breasts they clung, have perished from the severity of cold.

247 Preservation of equable temperature.

One of the most interesting facts relating to the subject of animal heat, is the capacity of preserving the equable temperature of their bodies, possessed by most animals. Man himself can live with little inconvenience in the frozen regions of Spitzbergen, and under the equatorial heats of Africa. He can even support a greater degree of heat than is perhaps ever known to take place from the rays of the sun, as is proved by the experiment of Drs Blagden and Fordyce in heated rooms; these gentlemen having remained for 15 minutes together in a heat exceeding 130°. The heat supported by some of the inferior animals is still more extraordinary. A dog has been known to live for a considerable time in air heated to 260°, and still the heat of his body was not raised more than 2° above its natural standard. A frog has lived for more than 25 minutes when laid on flannel,

nel, heated from 95° to 106°. Fishes live very well at 72°; and Lucas, in his history of mineral waters, speaks of carp that were living in a hot bath, whose temperature was at least equal to that of the human body.

How this equable temperature is preserved, cannot be completely explained. We know that the heat of the human body is commonly moderated by perspiration; but in some cases, as in that of Dr Fordyce alluded to above, where the heated atmosphere was filled with watery vapour, this could have little effect. We can ascribe it only to the action of the living principle.

248 **Voice.**

It was long ago observed by Aristotle, that those animals only who possess lungs, have a true voice, and this opinion is confirmed by the experience of modern naturalists. We find, that only mammalia, cetacea, birds, reptiles and serpents, can utter vocal sounds. Several tribes below these do indeed emit certain sounds, especially insects; but these are owing to vibrations of the air in consequence of the agitation of their external organs. It is only in mammalia and birds that the voice becomes an interesting object of enquiry; for that of the cetacea is little more than blowing and grunting, and that of the other two classes is either hissing or croaking.

249 **Amazing variety of the human voice.**

Nothing can exceed, in variety and execution, the human voice; as will readily be allowed, if we consider the complicated structure of the human vocal organs, and the almost infinite variety of changes of which they are susceptible. Dr Barclay has calculated these with great accuracy, proceeding on the principle, that where a number of moveable parts constitutes an organ destined to some particular function, and where this function is varied and modified by every change in the relative situation of the moveable parts, the number of changes produceable on the organ must at least equal the number of muscles employed, together with all the combinations into which they can enter. Now, the muscles proper to the five cartilages of the larynx, are at least seven pairs; and fourteen muscles that can act separately or in pairs, in combination with the whole, or with any two or more of the rest, are capable of producing 16,383 different movements; not reckoning as changes the various degrees of force and velocity, nor the infinitely varied order of succession by which they may occasionally be brought into action. The number appears almost incredible; but to lessen the surprise, it must be recollected that we speak not here of the powers possessed by any individual, which will depend on habits and circumstances, but on the powers of the vocal organs, considered in the abstract, free from all the influence of custom, equally indifferent, and equally disposed to act in any order of succession, in any combination, and with any degree of force and velocity of which their original powers were susceptible.

If the powers we have mentioned appear astonishing, and able to account for many thousands of these varieties observed among the voices of the human species, we have further to add, that the muscles alluded to are only the proper muscles of the *larynx*, or the muscles restricted in their attachments to its five cartilages. These are but a few of the muscles of voice. In speaking we use a great many more. Fifteen pairs of different muscles, attached to the cartilages, or *os hyoides*, and acting as agents, antagonists, or directors, are constantly employed in preserving the cartilages of the larynx steady, in regulating the place of their situation, or moving them as occasion requires, upwards and downwards, backwards and forwards, and in every way, directly and obliquely, according to the course of the muscular fibres, or in the diagonal between different forces. These muscles, independent of the former, are susceptible of 1,073,741,823, different combinations; and co-operating with the seven pairs of the larynx, of 17,592,186,044,415, exclusive of the changes which must arise from the different degrees of force and velocity, and the infinitely varied order of succession in which they may be brought into action.

But these are not all that co-operate with the larynx, either in forming or changing the voice; the diaphragm, the abdominal muscles, the intercostals, and all that directly or indirectly act on the air, or on the parts to which the chondral and hyoidal muscles are attached, contribute their share. The *os hyoides* could not be raised unless the inferior jaw-bone were previously fixed by the *temporals*, *masseters*, and internal *pterygoids*; and a similar assistance is likewise furnished by several other auxiliary muscles that fix the head, *sternum*, and *scapula;* to these we must add some pairs belonging to the *pharynx* and *isthmus faucium*, and some also belonging to the tongue, which, combining with others, give to that organ an inconceivable variety of movement; and so quickly, that, in rapid utterance, they change its state 3000 times in a minute. Thus Haller could articulate 1500 letters in a minute, which required 1500 contractions, and as many relaxations of the lingual muscles †.

250 **Mechanism of voice and speech.**

The principal organ of voice is the larynx, which is proved by the circumstance that, when this is injured, the voice is either lost, or rendered very indistinct. In ordinary respiration the chink of the glottis seems to be in a relaxed state, and when this chink is contracted, voice is produced, and the sound of the voice is more or less shrill, according as the *glottis* is more or less contracted. By this contraction of the glottis alone we can produce only inarticulate sounds, varied indeed almost infinitely with respect to intensity and tone, by the action of the muscles. The production of speech requires the action of the tongue, the lips, the palate, and the teeth; and the articulations are most complete, when all these parts are most perfect in their structure, and in the most healthy condition. Too great length or shortness of the tongue, swelling of this organ in consequence of inflammation, &c. imperfection of the palate, loss of the teeth, swelling of the lips, all serve to render speech imperfect and inarticulate. The strength of the voice depends on the quantity of air expired, and on the contraction of the glottis; and consequently those animals who have the most capacious and most dilatable lungs, together with an ample cartilaginous and elastic larynx, will, other things being equal, have the strongest voice.

251 **Ventriloquism.**

Among the various effects of the human voice, there is none more calculated to produce surprise in the hearers, than that extraordinary talent which some men possess of deceiving their hearers into a belief, that the sounds which they utter do not proceed from the real speaker, but from situations at a distance. This talent has been termed *ventriloquism*, from an idea that the voice of the speaker proceeded not from the mouth, but from the belly. The most remarkable instance of this rare talent of which we have heard, is that of M. Fitz-James, who was formerly at Paris, and exhibited in London in the year 1803. Mr Nicholson has given an amusing,

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† *Barclay's Anat. Nomen.* p. 70.

amusing account of the performance of this ventriloquist, and we shall present part of it to our readers.

After some remarks on the nature of ventriloquism, which we shall notice presently, and on the difficulty of ascertaining the direction of the sound, Mr Nicholson thus proceeds:—"We should scarcely be disposed to ascribe any definite direction to it; and consequently are readily led to suppose it to come from the place best adapted to what was said. So that when he went to the door, and asked in French (in which the whole performance was carried on), 'are you there?' to a person supposed to be in the passage, the answer in the unusual voice was immediately ascribed by the audience to a person actually in the passage; and upon shutting the door and withdrawing from it, when he turned round, directing his voice to the door, and said, 'stay there till I call you,' the answer which was lower, and well adapted to the supposed distance, and obstacle interposed, appeared still more strikingly to be out of the room. He then looked up to the ceiling, and called out in his own voice, 'what are you doing above?' 'do you intend to come down?' to which an immediate answer was given, which seemed to be in the room above, 'I am coming down directly.' The same deception was practised on the supposition of a person being under the floor, who answered in the unusual, but a very different voice from the other, that he was down in the cellar putting away some wine. An excellent deception of the watchman crying the hour in the street, and approaching nearer the house, till he came opposite the window, was practised. Our attention was directed to the street by the marked attention which Fitz-James himself appeared to pay to the sound. He threw up the sash and asked the hour, which was immediately answered in the same tone, but clearer and louder; but on his shutting the window down again, the watchman proceeded less audibly, and all at once the voice became very faint, and Fitz-James in his natural voice said, 'he has turned the corner.' In all these instances as well as others which were exhibited to the very great entertainment and surprise of the audience, the acute observer will perceive that the direction of the sound was imaginary, and arose entirely from the well-studied and skilful combinations of the performer. Other scenes which were to follow required the imagination to be too completely misled to admit of the actor being seen. He went behind a folding screen in one corner of the room, when he counterfeited the knocking at a door. One person called from within, and was answered by a different person from without, who was admitted, and we found from the conversation of the parties, that the latter was in pain, and desirous of having a tooth extracted. The dialogue, and all the particulars of the operation that followed, would require a long discourse if I were to attempt to describe them to the reader. The imitation of the natural and modulated voice of the operator, encouraging, soothing, and talking with the patient; the confusion, terror, and apprehension of the sufferer; the inarticulate noises produced by the chairs and apparatus, upon the whole, constituted a mass of sound which produced a strange but comic effect. Some observers would not have hesitated to assert, that they heard more than one voice at a time; and though this certainly could not be the case, and it did not appear so to me, yet the transitions were so instantaneous, without the least pause between them, that the notion might very easily be generated. The removal of the screen satisfied the audience that one performer had effected the whole.

"His principal performance, however, consisted in the debates at the meeting of *Nanterre*, in which there were twenty different speakers, and certainly the number of different voices was very great. Much entertainment was afforded by the subject, which was taken from the late times of anarchy and convulsion in France; when the lowest, the most ignorant part of society, was called upon to decide the fate of a whole people by the energies of folly and brute violence. The same remark may be applied to this debate, as to the other scene respecting tooth-drawing; namely, that the quick and sudden transitions, and the great differences in the voices, gave the audience various notions, as well with regard to the number of speakers, as to their positions and the direction of their voices *."

How explained.

Various explanations of this peculiar modification of voice have been given. From the report of Fitz-James himself, it appeared to Mr Nicholson, that by long practice he had acquired the faculty of speaking during the inspiration of the breath, with nearly the same articulation, though not so loud, nor so variously modulated, as the ordinary voice, formed by expiration of the air. M. Richerand, who heard Fitz-James at Paris, gives a different account of the matter. He says that every time the ventriloquist exerted this unusual peculiarity, he suffered distension in the epigastric region; that sometimes he perceived the wind rolling even lower, and that he could not long continue the exertion without fatigue. Richerand believes that the whole mechanism of this art consists in a slow, gradual expiration, drawn in such a way, that the artist either makes use of the influence exerted by volition over the muscles of the parietes of the thorax, or that he keeps the epiglottis down by the base of the tongue, the apex of which is not carried beyond the dental arches.

He always made a strong inspiration just before this long expiration, and thus conveyed into the lungs a considerable mass of air, the exit of which he afterwards managed with such address. Therefore repletion of the stomach greatly incommoded the talent of M. Fitz-James, by preventing the diaphragm from descending sufficiently to admit of a dilatation of the thorax, in proportion to the quantity of air that the lungs should receive. By accelerating or retarding the exit of the air, he can imitate different voices, and induce his auditors to a belief, that the interlocutors of a dialogue kept up by himself alone, are placed at different distances †.

Mr Gough in an ingenious paper, containing an investigation of the method whereby men judge, by the ear, of the position of sonorous bodies, relative to their own persons, explains the phenomena of *ventriloquism*, on the principles of reverberated sound, and considers it as consisting in the talent of making the voice issue only from the mouth; whereas he thinks that in ordinary cases the different vibrations which are excited by the joint functions of the several vocal organs in action, pass along the bones and cartilages from the parts in motion, to the external teguments of the head, face, neck, and chest, from which a succession of similar vibrations is imparted to the contiguous air, thereby converting the upper half of the speaker's body into an extensive seat of sound. He thinks that the sounds proceeding from the mouth of a ventriloquist are uttered in such a direction that the hearers may receive the impression of some echo with much more force than they can receive the original sounds *. It may be doubted whether such echoes can take place in an ordinary room filled with a large assembly; and on the whole we are inclined to consider this phenomenon as being effected partly by the gradual emission and a skilful management of a large quantity of air taken in by a full inspiration, and partly by the influence which the performer is capable of exerting over the imagination of his hearers.

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* *Philos. Jour.* 8vo. vol. iv. p. 203, 252

† *Richerand's Physiol. by Kerrison*, p. 376.

253 Voice of brutes. Several of the mammalia have a characteristic voice, which is formed by particular organs. These are in some animals tense membranes; in others peculiar cavities opening into the larynx, and sometimes appearing like continuations of the laryngeal ventricles. Thus the neighing of the horse is effected by a delicate, and nearly falciform, membrane, which is attached by its middle to the thyroid cartilage, and has its extremities running along the outer margins of the opening of the glottis. The braying of the ass is produced by means of a similar membrane, under which there is an excavation in the thyroid cartilage. In this animal there are also two large membranous sacs opening into the larynx. The purring of the cat seems to be owing to two delicate membranes that lie below the ligaments of the glottis. Some of the monkey tribe, especially the *simia seniculus* and beelzebul, have the middle and fore part of the *os hyoides* formed into a spherical bony cavity, by which these animals are enabled to produce those horrible and penetrating tones, which can be heard at vast distances, and have gained them the name of howling apes †. See MAMMALIA, N° 33.

254 Voice of birds. The simplest vocal organ seems to be that of birds. These animals have, on the sides of the windpipe next the lungs, and at the opening of the bronchiæ, two membranous folds which partly close the pulmonary aperture of the windpipe, and the aperture next the head is susceptible of great contraction and dilatation. In short, the vocal organ of birds may be considered as one of the most perfect wind instruments, very much resembling, both in its structure and effect, a clarinet or hautboy, the opening next the lungs being similar to the reed of these instruments. For some remarks on the song of birds, see ORNITHOLOGY, N° 42; and for farther observations on the voice, see ANATOMY, Part I. N° 122.

255 Relations of respiration with other functions. In tracing the relations of respiration with the preceding functions, we must deviate a little from our usual order, and begin with those between respiration and *circulation*, as it seems to be through the medium of the circulating system that respiration principally acts on the other functions. The relations between respiration and circulation are the most immediate and the most obvious.

256 With circulation. When the *breathing* is most free and rapid, the circulation is most vigorous and active; while in laborious or interrupted respiration, the action of the heart and arteries becomes slow, feeble, irregular; and where the lungs are deprived of oxygenous gas, the *arteries* gradually cease to pulsate, and soon after the motion of the *heart* ceases. If the stimulus of oxygen be not too long withheld, so that the lungs can again be excited to action, first the heart, and then the arteries, gradually renew the exercise of their functions, and the circulation proceeds as before. On the application of these principles depends the recovery of those apparently dead from *asphyxia* (suffocation, drowning, &c.) When the circulation becomes languid from indolence, from depressing passions or the want of accustomed stimuli, we feel about the breast a peculiar sensation, which physicians call *anxiety*, and which is relieved by a deep inspiration; by sighing, yawning, &c. Violent exertions of the respiratory organs, such as laughing, coughing, singing, talking unusually long or loudly, quicken the circulation, sometimes to an alarming degree, so as to occasion hæmorrhage in such as are predisposed to that affection. Breathing in an atmosphere that is much rarefied, as on the top of a high mountain, has often the effect of producing plethora and hæmorrhage; though this, perhaps, is imputable rather to a want of the ordinary pressure on the surface of the body.

257 With sensation. When the circulation through the lungs is impeded or obstructed, a determination of blood takes place to other parts, especially to the head. The effects produced on the brain and other organs of sensation, by the breathing of impure air, are dreadful. When the same quantity of air is repeatedly respired, there is experienced, first, great anxiety about the breast, and this soon becomes intolerable; the face swells, becomes livid, or even black, and feels excessively hot; sparks of fire seem to dance before the eyes; the sight becomes depraved; giddiness, ringing in the ears, and confusion of thought succeed; and if fresh air be not soon supplied, the subject of the experiment loses both sensation and motion, and falls into a state resembling apoplexy †. When rarefied air is breathed, the nervous system experiences a kind of excitement; agreeable sensations are produced with a disposition to mirth and cheerfulness; but if the person continue for some time in such a situation, an unusual languor, heaviness, and disposition to sleep, come on ‡. We need not here describe the pleasurable sensations excited by the respiration of nitrous oxide, as these have been already related under CHEMISTRY, N° 366. The exhilarating effects which a pure and serene atmosphere produce on the general system, and the uneasy sensations experienced under a thick and clouded sky, are partly referable to this head. The nervous system also acts on the organs of respiration. In some affections of the brain, respiration is much quickened, while in others, especially the comatose affections, it is slow, laborious, and often attended with that peculiar noise called *stertor*. It is well known what effect anxiety, eagerness, hope, or desire, have on the respiration. According as one or other of these passions is predominant, the breathing becomes hurried, irregular, or suspended.

258 With motion; An evident relation takes place between respiration and motion. The breathing is quickened by exercise; and when there is a considerable debility of the muscular system, the slightest exertion produces hurried respiration, panting, &c. In those animals that possess the greatest powers of motion, respiration is most free, and the air most extensively diffused over the body. In birds, not only the lungs are very extensive, but the air is conveyed into the bones of the skull, and into the hollows of the larger cylindrical bones; and in insects which have the most rapid motions, the air penetrates to every part of the body. Motion, as well as sensation, becomes unusually free and vigorous in rarefied air, and during the respiration of nitrous oxide; while in cases of impeded or obstructed respiration, the action of the muscles is languid and feeble. Indeed, if we may implicitly rely on the experiments that have been made on the respiration of de-oxygenated gases, the muscular fibres are among the first organs that are injured. We are told that by the admission of black blood, or blood that has not undergone the necessary changes by healthy respiration, the muscles lose their power of contraction, and even their irritability.

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* *Manchester Memoirs*, vol. x. part ii. v. 622.

† *Blumenbach's Comp. Anat.* chap. xv.

† *Kite's Essay on Apparent Death*, p. 25.

‡ *Saussure Voyage dans les Alpes*, p. 559.

259 With digestion.

The organs and functions of respiration sympathise with those of digestion. When the former function is most free, the latter is generally most healthy; the respiration of pure or rarefied air, or of the nitrous oxide, is attended with an increase of appetite, and of the digestive powers, as was experienced by M. Saussure while wandering among the Alps, and by Davy while respiring the *gas of Paradise*. Again, when digestion is impaired, or when the stomach is overloaded, the breathing is rendered difficult, laborious or irregular, and in many cases of affection of the stomach, cough is a very common symptom. These effects produced on the respiratory organs in consequence of impaired digestion, are ascribable chiefly to the pressure on the diaphragm by the distended stomach.

Many other relations might be pointed out between respiration and the other functions of the animal economy, but our limits do not permit us to enlarge further on the subject *.

For an account of the morbid affections of respiration, such as *sneezing*, *hiccup*, *coughing*, *anxiety*, *dyspnœa*, or *difficulty of breathing*, see the article MEDICINE.

CHAP. IX. *Of Nutrition and Assimilation.*

260 Nature of nutrition.

THE function by which the nutritious particles received by a living being are assimilated to the nature of that being, or become part of its substance, is properly called *nutrition*. This is the completion of the process which, in most animals, is the combined result of several other operations. Thus, in the superior animals, from man to the mollusca, the whole process of nutrition consists of *digestion*, *absorption*, *circulation*, and *respiration*; by the two last of which the nourishment received is changed into perfect blood, and fitted for the support and renewal of the several parts of the system. From the account of the constituent parts of the blood given under CHEMISTRY, N° 2660, it will appear, that this fluid contains within itself the principles of which every part of the body is composed. Thus it contains *fibrine*, which is the chief principle of the muscular parts; *phosphate of lime*, which forms the basis of the bones; *albumen* and *gelatine*, the chief constituents of cartilages, ligaments and tendons, &c. These principles are conveyed by the arterial blood, during its circulation, to those parts of the system where they are required, for renewing waste, or supplying deficiencies, and thus they are assimilated to the nature of the body.

261 Each assimilating organ produces peculiar changes.

The power of assimilation, so remarkable in living bodies, is not the same in every assimilating organ; but each has the property of converting the materials it receives (provided they be susceptible of this conversion) into a peculiar substance. Thus the stomach always converts the food into *chyme*; the intestines change it into *chyle*; but if chyle, or what is very similar to it, fresh milk, be received into the stomach, this organ exerts on it the usual change, and does not pass it forward into the intestines unaltered, though we know by experiment, that fresh milk is capable of being taken up unchanged by the absorbents of the bowels *. Again, blood is always perfected within the circulating vessels; and if chyle or fresh milk be injected into the arteries, it produces dangerous effects, while the fresh blood of another living animal may be transfused into these vessels without injury. In like manner, if a piece of fresh muscular flesh be cut from a living animal, and applied to the muscles of another living animal, also newly divided, the two parts unite, and are immediately assimilated; and even fresh bone may, in the same manner be ingrafted on the living bones of the same, or of a different species of animal †; while substances that are foreign to the nature of the animal body, when introduced into the blood-vessels, prove fatal, and when inserted into a wounded muscular or bony part, prevent the wound from healing.

262 Assimilation a chemical process.

These circumstances show that assimilation is a chemical process, though modified and regulated by the action of the living principle. The chemical nature of assimilation is most distinctly proved by the well-known experiment of colouring the bones of an animal, by feeding it on madder. The particles of the madder, which we know to have a strong affinity for phosphate of lime, are carried unchanged from the stomach into the blood-vessels, and are thence conveyed, probably in combination with the phosphate of lime there contained, into the substance of the bones, where they are deposited, and remain for a considerable time.

263 Nutrition not performed by nerves.

We have considered nutrition as performed by the circulating vessels. It has been supposed that the nerves are the organs of nutrition; but this strange hypothesis is completely overturned by an experiment of the second Monro, which proves that the limb of a frog may be preserved alive and nourished by the blood-vessels, after its communication with the brain has been cut off by dividing the nerves.

264 Nutrition in insects and zoophytes.

In insects and zoophytes, where there are no circulating vessels, nutrition must be a very simple operation. According to Cuvier, it is performed by *imbibition*; the pores of the animal's body receiving immediately the nutritious fluids on which it feeds.

265 Assimilating power limited.

In plants and animals, the assimilating power has always certain limits prescribed to it; its influence is very generally confined to the sort of food congenial to the species, and its strength is varied according to circumstances, as the age, the habits, and the state of health. Those which are young assimilate faster than those which are old; and one species, which may partly be owing to the nature of their food, will assimilate much faster than another. Certain worms that feed on animal and vegetable substances will, in twenty-four hours after their escape from the egg, become not only double their former size, but will weigh, according to Redi, from 155 to 210 times more than before. Most oils are of very difficult assimilation; and those which are *volatile* will often resist the long-continued and the varied action of the living organs; will mingle with the parts, and, undecomposed, communicate their flavour.

Other circumstances respecting nutrition have been noticed in the first part of ANATOMY, N° 130; and the chemical doctrine of assimilation is more fully considered under CHEMISTRY, N° 2567—2571.

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* See *Bichat Recherches Physiol. sur la Vie et la Mort.*

* *Fordyce on Digestion*, p. 159.

† *Phil. Mag.* vi. 308.

CHAP. X. *Of Secretion.*

266 **Secretion.** THAT function by which any organ, or set of organs, separates from the general mass of blood certain principles intended to perform some important office in the animal economy is called *secretion;* and the substances so separated, are called *secretions.*

267 **Organs.** The secretory organs in the more perfect animals are very numerous, and some of them very complex. The most simple of them seem to be the *cellular texture,* and the *mucous membranes.* The next in simplicity are the *conglobate glands,* and perhaps the *spleen,* while the more complex organs are the *liver,* the *testicles,* the *atrabiliary capsules,* &c. An account of all these organs, as they occur in the human body, has been given in the first part of the article ANATOMY; and the corresponding organs of the inferior animals, with others not found in man, are described by writers on comparative anatomy, especially Cuvier and Blumenbach.

268 **Kinds of secretion.** Secretion appears to be of three kinds: 1. *Transudation,* in which the secreted matters merely ooze through the pores of the secreting organ. This takes place in the lowest classes of animals, as in zoophytes, insects, and some worms, but rarely in the human subject. 2. *Exhalation,* in which the secreted fluids are poured out into cavities by certain branches of the arteries with open mouths, called *exhalants.* This appears to take place in many organs of the most perfect animals, especially from the mucous membranes, the synovial glands, &c. 3. *Secretion,* properly so called, in which the blood passes through glandular bodies, where a part of it is decomposed, and carried out in another form by particular tubes called *excretory ducts.* This is the case with most of the secreting organs, as the salivary glands, the lachrymal glands, the liver, the pancreas, the testicles, and a few others.

269 **Secreted matters.** The secreted fluids are chiefly the following: *lymph, serum, tears, mucus, saliva, pancreatic juice, gastric juice, enteric juice, bile, semen, synovia, fat, marrow, cerumen* or *ear-wax,* and in the female, *milk.* The other matters secreted, which may rather be termed solid than fluid, are *albumen, gelatine, fibrine,* and *phosphate of lime.* On the nature and properties of all these substances, see the article CHEMISTRY, Chap. xix. sect. 3.

270 **General modifications of secretion.** With respect to the secretions in general, we may remark, that they are considerably influenced by age, sex, various affections of the mind, and various bodily diseases. They are formed by organs which are sometimes capable of supplying the deficiencies of each other; they are subjected to the influence of the atmosphere, and to the temperaments of the body; they are sometimes mixed together, and by this combination their nature is changed.

We shall now briefly examine the action of three of the secreting organs, viz. the *cellular membrane,* the *liver,* and the *spleen.*

271 **Action of the cellular membrane.** From the extensive distribution of the cellular membrane it is reasonable to conclude, that it is intended to perform several important offices in the animal economy. One of its most obvious uses is to form a general connecting medium between every part of the structure, while it at the same time separates and distinguishes every organ. From its elasticity, and the lubricating fluid which it holds within its cells, it facilitates motion, and thus assists the action of all the muscular parts and organs. That it is susceptible of great dilatation is proved by the phenomena of anasarcous dropsy; and the gradual evacuation of the water when anasarcous limbs are punctured, as well as the passage of extraneous bodies below the skin from one part to another, seem to show that it possesses considerable contractile powers. It is chiefly, however, as a *secreting* organ that we are here to consider the *cellular membrane;* and in this way its function is of the utmost importance. The *fatty matter,* that is so copious in most of the superior animals, is contained within particular cells or *bags* of the cellular membrane, and is found in greatest quantities below the skin, especially on the *sternal* part of the belly, and about the kidneys. In some animals, as the *hog,* the *seal,* the *walrus* and the *cetaceous* tribes, it forms a layer several inches in thickness, and in all the water animals above mentioned it is nearly fluid. To these animals it not only serves the purposes of a warm covering by the slowness with which it conducts heat; but, by diminishing their specific gravity, renders their motions on the surface of the water much more easy and expeditious. One of the most important uses of the fat seems to be to supply nourishment to the body, when the ordinary channel is obstructed, or the system rendered incapable, from torpor or disease, of receiving food. When fat persons are attacked by fever, or similar acute diseases, they become emaciated, sometimes to so great a degree, as to appear a mere skeleton; and those animals who sleep during winter, though very fat when they retire to their dormitories, are extremely lank and lean when they quit these on the return of spring. In all these cases the fat alone is absorbed, and supplies the waste that takes place in the body, and would otherwise prove fatal.

On the actions of the cellular membrane, see Bichat, *Anatomie Generale,* tom. i.

272 **Action of the liver.** Some physiologists have supposed that the bile secreted by the liver is not formed entirely from the blood of the *vena portarum,* but partly from the hepatic artery. Dr Saunders who has examined the arguments in favour of this supposition, decides against it, and considers the usual opinion of the bile being solely secreted from the blood of the *vena portarum,* as quite satisfactory. It has also been supposed, that the whole of the bile is not secreted by the liver, but that the gall bladder has a share in this office, and is not merely a reservoir, like the urinary bladder. This supposition is highly improbable, although we think there can be little doubt that the bile undergoes, within the gall bladder, some peculiar changes, which render it better fitted for the functions it has to perform. We know that the gall bladder is very muscular, and that there is an appearance of follicles within it. It is therefore probable that some matter is secreted from its internal surface, which produces a necessary change in the bile.

273 **Uses of the bile.** The principal use of the bile seems to be to stimulate the intestines, and thus keep up their energy and peristaltic motion, though it is probable that, besides this office, it performs several others of importance in the animal economy, such as assisting in the decomposition of the food, and thus forming chyle; and acting as a

general stimulus to the system. That it has this last effect is probable from the torpor, inactivity, and dejection that attend hypochondriacal and chlorotic affections, in which this secretion is defective. Too great a secretion, or rather excretion of bile, is attended with violent purging *.

On the nature of the bile, and biliary concretions, see CHEMISTRY, N° 2664.

274 Uses of the spleen. Few subjects in physiology have given rise to more discussion, and few have been considered with so little success, as the use of the spleen in the animal economy. That an organ so large, and so well supplied with blood, should be intended for some important function, is scarcely to be doubted; and yet the instances of animals that have lived, seemingly with little inconvenience, after the spleen had been cut out, seem to prove that this organ is not of such great importance as it appears to be. The conjectures respecting its uses are various, and some of them not a little ludicrous. Some have supposed that it acted by its weight and pressure on the stomach, and thus promoted digestion at one time, and counteracted hunger at another; some, that it was intended to dilute and attenuate the blood; others, to deprive that fluid of its superabundant oil; another party, that it contributed to form the red globules of the blood; and some of the older physiologists supposed that it secreted that fluid to which they gave the name of *black bile*.

275 Opinion of Dumas. Dumas is of opinion that it is a sort of supplementary organ, both to the liver and the kidneys, separating from the blood part of its serosity, and then delivering it over to the liver in a proper state for the formation of bile; and furnishing to the kidneys another portion of serosity to form the watery part of the urine *. That at least a part of these opinions of Dumas has some foundation, will appear from the following summary of the late experiments of Mr Everard Home.

276 Experiments of Mr Home. Prosecuting the inquiry respecting the state of the stomach during digestion, which we have formerly alluded to (see N° 161), Mr Home found that during digestion, the fluids taken into the stomach are principally contained in the cardiac portion; and he inferred, from the uniform consistence of the chyme in the pyloric portion, that a great part of the fluids are carried out of the stomach without ever reaching the *pylorus*. As he conceived very naturally, that the lymphatics of the stomach were inadequate to this office, he conjectured that the fluids might pass off by the spleen. He proved, by a decisive experiment, that liquors might pass through the stomach without going through the pylorus, and he also found at the same time, that the spleen was turgid, unusually large, and its external surface very irregular; and when cut into, small cells were every where met with, containing a watery fluid, and occupying a considerable portion of its substance. Rudiments of these cells had been seen before by Malpighi, who considered them to be glands, and by Cuvier, who calls them corpuscles; but the cells in a distended state seem not to have been examined till Mr Home was led to look for them, in consequence of the above experiment. Mr Home varied this experiment, by giving animals a decoction of madder, and an infusion of rhubarb, and obtained similar results. Part of the fluid swallowed was again rejected by vomiting; but of that which remained it was always found that a part had escaped, without any possibility of passing by the *pylorus*, as this was secured by ligature. It did not probably escape by the absorbents, as these were not so much distended by fluid as to be visible; and it certainly did enter the spleen, as there was there found a quantity of liquor, which was proved, by an alkaline test, to contain rhubarb. A large quantity of urine was found in the bladder, also impregnated with rhubarb *.

277 Spleen carries off fluid from the stomach. From these experiments it appears, that the spleen is capable of carrying off from the stomach, a part of its fluid contents, thus affording a much nearer passage to the bladder than through the absorbents. If this investigation, on further trials, shall prove equally satisfactory, it will explain why the bladder is often distended with urine in a short time after drinking; and will do away the necessity of having recourse to the disputed hypothesis of the retrograde action of the absorbents.

278 Peculiar animal secretions. In the inferior classes of animals there are a number of peculiar secretions, which, from their utility in medicine or the arts, or from their noxious or unpleasant effects, are deserving the attention of physiologists. We can here only mention a few of the more important. The nature and properties of most of them are explained under CHEMISTRY.

Some of the mammalia secrete matters that have a very strong smell, as *musk*, *civet*, *castor*, and in particular the fluid emitted from the hide of several of the weazel tribe, beside the civet cat. *Ambergris* is secreted by some species of whales. Birds, especially water fowls, secrete a large quantity of oily matter, which they use in dressing their feathers. Some reptiles, especially the toad, secrete an acrimonious fluid, which seems to serve them as a weapon of defence. Many serpents, as is well known, produce a most virulent poison, which they insert into the wounds inflicted by their fangs. Some fishes secrete fluids of a similar tendency. Few animals, however, form secretions so various and so useful, as the insect tribes, from whom we procure *cochineal*, *kermes*, *lac*, *silk*, &c. Some of the mollusca, as the muscle, and the spinning slug, also secrete a matter similar to silk, by means of which they either secure themselves firmly in their situations, or facilitate their progressive motion. The *ink* of the *cuttle fish*, supposed with no small probability, to be the basis of Indian or Chinese ink, is also a remarkable animal secretion, which seems intended by nature to screen the animal, and assist it in eluding the vigilance of its pursuers.

279 Vegetable secretions. There are also many important vegetable secretions, constituting what are called *gums*, *resins*, and *gum-resins*; as *gum-arabic*, *gum-dragant*; *guaiac*, *dragon's blood*; *assafoetida*, *gamboge*, *myrrh*, *aloes*, and many others; for an account of which see CHEMISTRY and MATERIA MEDICA.

CHAP. XI. *Of Excretion.*

280 Excretion. THE function of excretion differs but little in its nature from that of secretion already considered. As the organs of secretion separate from the blood those substances which are useful in the animal economy, so the excretory organs separate from the blood, or from the food taken into the stomach, those substances which are to be conveyed out of the body as excrementitious, viz. the solid excrement, the urine, and perspiration.

281 Organs. The organs of excretion, then, are chiefly the bowels, especially the larger intestines, the kidneys, with their

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* *See Saunders on the Liver.*

* *Principes de Physiol.* tom. iii. p. 592.

* *Phil. Trans.* for 1808, p.

appendages, the ureters and urinary bladder, and the skin. For an account of these in the human body, see ANATOMY, Part I.; and for the varieties of these organs in such of the inferior animals as possess them, and for the means by which their absence is supplied in others, see the works of Cuvier and Blumenbach already quoted.

282 **Excretion by the intestines.** The physiology of intestinal excretion requires little explanation. The remains of the food, after the nutritious chyle has been extracted from it by the lacteals, are carried onward through the colon and rectum by the peristaltic motion of the intestinal canal, excited to action by the stimulus of their contents, and of the bile, and assisted by the pressure of the abdominal muscles, till they reach the extremity of the rectum, when becoming more stimulant, partly by their bulk, and partly by their increased acrimony, they rouse the muscular fibres of that intestine to greater action, so as, with the assistance of the abdominal muscles, to overcome the resistance of the *sphincter*, and are thus expelled.

283 **Relations.** Intestinal excretion is influenced by most of the preceding functions. 1. By the nervous power; as we find that in cases of paralysis, the excrements are not passed without artificial means, or they are voided involuntarily. 2. By motion. Thus we find that the action of the bowels is increased by exercise, and lessened by indolence and a sedentary life; though the quantity of excrement passed is greater in the latter case than in the former, shewing that the stimulus of the excrementitious matter is not sufficient without muscular action, to produce the regular performance of this function. 3. By digestion. It is well known that the stronger the digestive powers of the stomach, the more active are the bowels, and again, when these latter are overloaded with excrement, the functions of the stomach are disordered. 4. By secretion. The action of the intestines is increased, when that of the secretory organs which pour their contents into the alimentary canal, becomes unusually great, viz. in unusual secretions of bile or mucus, as in *cholera* and *diarrhœa*; while, when those secretions are defective, as in cases of *jaundice*, the intestines become unusually torpid.

The morbid affections of intestinal secretion have been considered under MEDICINE, N° 109—112, and 114, 115.

284 **Excretion by the kidneys.** The organs destined for the excretion of urine afford the most complete apparatus for this function of any that we shall have occasion to notice, consisting of an assemblage of glands, collected within one membrane; an excretory duct; a reservoir for collecting the excreted fluid, and a canal for conveying it out of the body. Indeed we may consider the kidneys rather as secreting than excreting organs, as the urine there formed differs so much in its nature and properties from the circulating fluids. We know, by a decisive experiment, that the kidneys perform the whole of this office, and that the other organs are intended for the excretion of the urine; for when the ureters are tied or obstructed next the bladder, we find that the secretion of urine still goes on, and that the ureters above the obstruction soon become filled and prodigiously distended.

The nature and properties of urine, in its natural state, and as altered in certain diseases, have been considered under CHEMISTRY, N° 2670.

As the urine contains two substances that are not found in the blood, viz. *urea* and *uric acid*, Dr Thomson concludes, on very probable grounds, that the office of the kidneys is not merely to separate from the blood, a quantity of water and salts, but that they exert on this fluid some peculiar action, decomposing some part of the blood, and forming some new substance or substances †.

285 **Relations.** The mutual relations between this excretion and the preceding functions, are not many, or very important. During certain affections of the nervous system there is a sudden and copious excretion of limpid urine, and some mental emotions produce an involuntary flow of it ‡. And in cases of palsy, an incontinence, or a total suppression of urine, is very common. This excretion is considerably influenced by motion, being less copious in those who use much exercise, or lead a laborious life.

The morbid affections referable to this excretion, are noticed under MEDICINE, N° 118—122.

286 **Excretion by the skin.** The excretion by the skin, or perspiration, has exercised the ingenuity of many physicians and physiologists, ever since the time of Sanctorius; and though it is not now considered as so essential to life and health as it was in the beginning of the 18th century, is certainly of great importance. The quantity of watery fluid occasionally thrown out by the skin in the form of sweat, proves that, by means of this organ, the blood is freed from a great deal of useless or perhaps injurious matter, which could not so conveniently, or so perfectly, be expelled by other outlets. The nature of the matter perspired, and the quantity of ordinary perspiration, have been investigated by many able experimentalists, the result of whose labours is given in the first volume of Johnson's *Animal Chemistry*; the fifth volume (third edition) of Dr Thomson's *System of Chemistry*; in a paper by Dr Kellie in the second number of the *Edinburgh Medical and Surgical Journal*, and in our article CHEMISTRY.

The principal facts that have been ascertained with respect to the perspirable matter thrown out by the skin, relate either to its quantity, or its chemical composition.

287 **Quantity of the perspiration.** I. The experiments on the quantity perspired, on which we can the most rely, are those of Lavoisier, Seguin, and Mr Abernethy. From these experiments we may deduce the following conclusions: 1. The greatest quantity of matter perspired in a minute, amounts to about 26 grains troy, the least to about 9 grains; giving an average of about 17 grains in the minute, or about 52 ounces in 24 hours. Dr Kellie estimates the quantity at about 30 ounces, which seems too small. 2. The quantity of perspiration is increased by drink, but not perceptibly by solid food. 3. Perspiration is the least in quantity immediately after a meal, and reaches its highest proportion during digestion.

288 **Its composition.** II. The perspirable matter is chiefly composed of a large quantity of water, some carbon or carbonic acid, a small quantity of another acid, supposed to be the phosphoric, and a peculiar oily matter of an odorous quality, differing in different animals, and, as it should seem, in different individuals. The perspiration of quadrupeds is frequently found to contain phosphate of lime, and sometimes urea. See CHEMISTRY, N° 2532.

289 **Relations.** As to the relations of perspiration with the preceding functions, we may remark that this excretion is increased by various passions of the mind, by exercise, by healthy and rapid digestion; that it is generally in proportion to the vigour and quickness of the circulation and respiration, and that it is capable of supplying the defect of the two former excretions. On the contrary,

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† Thomson's Chemistry, vol. v. 3d edit. p. 748.

‡ Merchant of Venice, act v. scene 1.

it is lessened by inactivity; by the impaired state of the digestive organs; by languid circulation and respiration, and by violent purging, or evacuation of urine.

Chap. XII. *Of Integumation.*

290 Uses of integuments as defence.

All living bodies are furnished with integuments, which are intended to afford them a defence against those injuries to which their situation is commonly exposed. Of the integuments, some are useful in preventing the dissipation of the fluids; some in resisting acrid and corrosive substances; some of them are indigestible in the stomach of animals, and some appear to be incorruptible in the earth. By these properties, seeds and the ova of insects are preserved for a considerable time, waiting the changes of soil or of season that are favourable to their evolution. They are protected from the action of weak membranous stomachs, and thus the animals who may swallow them contribute to their propagation. It is thus the seeds of the misletoe are dispersed, and deposited on the bark of the oak or the ash. There is a gelatinous substance frequently ejected by birds, and commonly called *tremella*, *nostoc*, or star-fall, which Dr Barclay has proved to be nothing else than the oviducts of frogs, which, as the embryo in form of an egg, moves along their winding canal, secrete that transparent and viscid matter which constitutes the albuminous part of the ovum, and feeds and protects the embryo while in water.

The most important circumstances with respect to integumation relate to the varieties of the integuments themselves, and to the changes or renovation of these in different animals.

291 Integuments useful by their hardness;

I. Some integuments are useful, chiefly from their strength and hardness. The *elytra* or shelly coverings of the beetle tribes afford an excellent defence for their membranous wings, when folded up; the shell of the snail lodges the intestines, when the animal comes forth to search for food, and affords a safe retreat to the animal, when it is threatened with any danger from without. The shells of some animals can be opened and closed by a muscular power; and some of them, as in the tail of the lobster, are so disposed in plates or scales, as to be no hindrance to the animal's motion. Several insects which pass a part of their time in the water, always compose for themselves a shell, where it is needful.

292 by their external covering;

Some integuments are covered with feathers, some with hair or thick down. Besides many other obvious uses of these coverings, they generally serve to repel insects; and being bad conductors of heat, tend to preserve an equal and necessary temperature. Some integuments are covered with prickles, which oppose the attacks of an enemy by the strength of their points, or by the venom which they infuse, as in the stings of nettles, and the down of some other plants, and some insects. Others again are moistened by a viscid secretion, which preserves the necessary softness of the parts, prevents evaporation, resists acrimony, enables some beings to destroy their enemies, and assists others in performing their progressive motions.

293 by their effluvia;

Both plants and animals, but particularly the former, are often protected by odorous effluvia from their integuments. These effluvia are the finer parts of their volatile oil, always inflammable, and so subtle, that the continual emission of it from wood or flowers does not sensibly diminish their weight. To this fragrance it is owing that the deadly nightshade (*atropa belladonna*), the henbane, hounds-tongue, and many others, are seen on almost every high road untouched by animals. The manchinelle-tree of the West Indies emits so very dangerous vapours, that the natives poison their arrows with its juices, and those have died who have ventured to sleep under its shade. The *lobelia longiflora* of America produces a suffocating oppression in the breast of those who respire in its vicinity. The return of a periodical disorder has been attributed to the exhalation of the *rhus toxicodendron*. Of all the vegetable effluvia, however, that afford defence to the plant from which they proceed, or annoyance to the animals that approach it, none are equal to those of the celebrated *bohun-upas*, or poison-tree of Java, whose exhalations have been said to extend to the distance of several miles, preventing all access of animals, or punishing the intruders with certain death. It is rather unfortunate for the botanical poets, that the effects of this poison have been greatly exaggerated, if indeed such a marvellous tree really exists *.

294 by their colour.

Various colours of the integuments afford a species of defence. Caterpillars which feed on leaves are generally green; and earth-worms the colour of the earth which they inhabit. Butterflies which frequent flowers are coloured like them. Small birds which frequent hedges have greenish backs like the leaves, and light-coloured bellies like the sky, and are hence less visible to the hawk who passes under them or over them. Those birds which are much amongst flowers, as the goldfinch, are furnished with vivid colours. The lark, partridge, and hare, are of the colour of dry vegetables or earth on which they rest; and frogs vary their colour with the mud of the streams which they frequent, and those which live on trees are green. Fish which are generally suspended in the water, and swallows which are generally suspended in the air, have their backs the colour of the distant ground, and their bellies of the sky. The *sphinx convolvuli*, or unicorn moth, resembles in colour the flower on which it rests; and and among plants, the nectary and petals of the *ophrys*, and of some kinds of the *delphinium*, resemble both in form and colour the insects which plunder them, and thus sometimes escape from their enemies by having the appearance of being pre-occupied. From colour being thus employed as a defence, many animals vary their colours with the seasons and circumstances; and those which are of different colours in summer according to the places which they inhabit, in winter assume in common the colour of the snow.

295 Change of integuments.

II. The changes that take place on the integuments consist either of a partial, or complete, renewal of them. As the more superficial integuments are commonly insensible to stimuli, and possess little or nothing of the vital principle; in all cases where they cannot be enlarged to admit of an additional increase of growth, or where they are not furnished with organs for repairing those injuries which they may suffer from accident or disease, the body is endowed by nature with a power of throwing them off, and of producing others in their stead. Thus, serpents and toads slough their skins; the crustacea cast their shells; the larvæ of insects change their cuticle; and several trees, especially the cork tree, throw off their outer bark. Even man himself generally changes the cuticle, which peels off in the form of scales. Most animals once a year change their hair, wool, or feathers, and have these renewed by a fresh covering; a process well known by the name of *moulting*. Some animals who do not usually cast their external covering, have the power of repairing this when injured. This is the case with most of the testacea, especially snails.

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* See *Pinkerton's Geography*, under *Java*.

Chap. XIII. *Of Transformation.*

296 Transformation.

The alterations which organized beings undergo from *metamorphosis* or transformation, are more striking than those which we have described in the preceding chapter. It has indeed been asserted, that these alterations consist in throwing off certain temporary coverings; but this expression is inaccurate, and arises from a want of precision of ideas. Transformation and change of integuments are really different; the truth is, transformation often takes place without any change of integuments, and there is often a change of integuments without any change of form. This new form is sometimes occasioned by a change of shape, consistency, and colour, as when the lobes of a seed are converted into seminal leaves. It is at other times occasioned by a change of proportion among the parts, and at others by the addition of new organs, as when the emmet receives wings, and the plume of the seed is fed by new roots striking into the ground: or, lastly, it is occasioned by a change in the form and organs, and in their mode of operation, as happens in a remarkable degree to some insects. Indeed, though all living bodies, both plants and animals, undergo some degree of transformation in the course of their existence, these changes are most remarkable in insects.

297 Transformation of reptiles;

Many reptiles undergo very curious changes, but these are most remarkable in the frog tribe. The larva or tadpole, as it is called, of the frog, is an animal with a large head, a long tail, no limbs, and commonly possessed of gills, all obviously very different, both in form, proportion, and uses, from the parts of the perfect animal. The curious appearance of what has been considered as the tadpole of the *rana paradoxa*, has led some naturalists to describe it as an animal of a different genus, either a fish or a lizard; see ERPETOLGY, p. 384.

298 of insects.

Many insects appear to consist of two distinct animal bodies, one within the other; the exterior, a creature of an ugly form, residing in the water, or under the earth, breathing by gills, or sometimes by tracheæ projecting from the tail, possessing a voracious and grovelling appetite, and having a system of sanguiferous vessels that circulates the blood towards the head. When all its parts decay and fall off, the creature inclosed succeeds in its stead: this often is an animal of a different form, generally lives in a different element, feeds on a different species of food, has different instruments of motion, different organs of sense, different organs of respiration and differently situated; and being endowed with the parts of generation, inclines to gratify the sensual propensity, and produces an embryo, which becomes like the first, and from which, in process of time, a creature is evolved similar to the former.

If the embryo or egg be deposited on a leaf, the leaf is frequently observed to bend, to wrap it in folds, intended for the purpose of protecting it from injuries and danger. If deposited in the body of an animal or plant, they accommodate themselves to its wants and necessities, and furnish a tumour which serves it for a nidus, and besides, like an uterus, supplies it with nourishment; and if deposited in the body of an insect, the creature provides for the future destination of its young charge with all the tender care of a parent, and then dies.

299 Parents of insects often not easily distinguished.

These circumstances, added to the great variety of forms which insects assume, renders it sometimes difficult to know who is the parent. We cannot, for instance, pronounce with certainty who is the true parent of the gordius, known by the name of the *seta equina*, or hair eel. A set of experiments which Dr Barclay once began with a view to throw some light on the subject, were unfortunately interrupted by an accident. He learned only, from a number of observations, that certain black beetles, at the end of summer, have the strongest propensity to run into the water, where they soon die; and that one or two, and sometimes three or four of those eels gradually drop from the beetle by the anus. Whether other insects provide for the gordius in this manner, we have not yet been able to determine.

300 Transformation accompanied by change of propensities.

In all living bodies possessed of a *sensorium*, the changes of form, as well as the changes of habit and of age, are usually accompanied with new propensities, appetites, and passions.

301 Consists in the evolution of parts.

Microscopic observations having demonstrated, that all the forms of the plant and animal existed previously in the seed or embryo; transformation must be owing entirely to the evolution of the different parts by means of nutrition.

302 Its uses.

What nature intends by transformation, we cannot determine; but by means of it different elements are peopled, the different seasons variously adorned, and animated nature wonderfully diversified without a multiplication of beings.

Chap. XIV. *Of Reproduction.*

303 Reproduction of parts.

In the present chapter we shall notice, first, the partial reproductions that take place in some classes of animals, and then take a general comparative view of the principal phenomena of generation, in the various classes of living beings.

304 In man and *mammalia*.

Experiments have proved, that even in the superior classes of animals, many parts of the body, when destroyed or removed, may be reproduced. A bone may be broken in such a manner, that part of it must be taken away, but in a few weeks the separated ends are brought together by the secretion of new bony matter, called *callus*. Little more than 24 hours have elapsed after a fracture, before nature begins her operations. The soft parts inflame; the periosteum becomes swelled; the vessels pour out coagulable lymph, and a pellucid, gelatinous substance appears about the broken extremities of the bone. Into this minute blood-vessels are gradually sent off from the arteries, and in no very long time phosphate of lime begins to be secreted, for rendering the whole firm and compact. In cases of *necrosis*, where the old bone entirely loses its vitality, new bony matter is secreted into the surrounding periosteum, which thickens and enlarges, and in time supplies the place of the old bone. When a muscular part is cut away, as in removing flesh that has become gangrenous, if the healthy function of the surrounding parts can be restored, and the loss of flesh has not been too great, the wound gradually fills up, not indeed with fleshy fibres, but with granulations very much resembling the ordinary cellular substance. It is well known, that the hair, nails, and skin, are occasionally renewed; but it will appear extraordinary that blood-vessels, and even nerves, have been reproduced. In cases of aneurism, where the trunk of the diseased artery is divided, so as to cut off the usual channel for the blood, the anastomosing branches become gradually enlarged, and even new branches appear to be formed for carrying on the circulation. What has been said above respecting the formation of *callus*, also proves the formation of new blood-vessels; and the observations of Mr John Hunter put this beyond a doubt. Till within these few years, it was thought impossible that a divided nerve should re-unite; but some late experiments of Mr Cruickshank have proved that this re-union may take place *.

Under this head we may mention some curious experiments that have been lately made by Dr Jones, on the means by which nature suppresses the hæmorrhage from divided arteries. These experiments were made on dogs, and the results of them lead us to conclude, that the following is nearly the process by which the hæmorrhage is suppressed. First, the divided artery contracts, and is drawn within the neighbouring parts; blood is gradually effused into the sheath of the artery and the adjoining cellular substance, where it is entangled, and affords a basis for the formation of a coagulum or clot, which surrounds the extremity of the divided artery, and prevents the farther effusion of blood, till another clot is formed within the mouth of the artery, plugging it completely up. Soon after there oozes out between the external and internal clot, a quantity of coagulable lymph, which cements all the parts together, and thus in time, if the artery divided be not very large, and the force of the circulation very great, the cavity of the vessel and the divided extremity, is obliterated, and all further loss of blood effectually prevented †.

305 Reproduction of parts, in the inferior animals; It is, however, in the lower classes that we are to look for the most remarkable instances of this provision of nature, particularly among the reptiles, crustacea, mollusca, worms, and polypes.

306 in reptiles; In many reptiles, the legs and tail, when cut off, are soon renewed, and even the eyes have been re-produced. Some interesting experiments on this subject by Spallanzani have been related under ERPETOLOGY, p. 316, to which we refer the reader.

307 in crustacea; In the crustacea, the legs and claws are very often torn away, either by accident, or by some voracious animal; but these never fail to be renewed in a short time, provided the animal is in good health. This is most remarkable in the craw-fish (cancer astacus, Lin.). It has been observed that when the claw of this animal is broken, the most distant part is gradually cast off, and about a day or two after, a red membrane, not unlike a bit of red cloth closes up the aperture. This is at first plain; but in the course of four or five days it assumes a convexity, which gradually augments till it takes the appearance of a small cone, which exceeds not a line in height. It continues, however, to stretch out, and in ten days it is sometimes more than three lines, or about one-fourth of an inch high. It is not hollow, but filled with flesh, and this flesh is the basis or rudiment of a new claw. The membrane that covers the flesh performs the same office to the young claw as the membranes do to the fœtus of the larger animals. It extends in proportion as the animal grows; and as it is pretty thick, we can perceive nothing but a lengthened cone. When 15 days are elapsed, this cone inclines towards the head of the animal. In a few days more its curvature increases, and it begins to assume the appearance of a dead claw. This claw, though at the end of a month or five weeks it has acquired the length of six or seven lines, which is more than half an inch, is still incapable of action. The membrane in which it is enclosed becoming gradually thinner, in proportion as it extends, gives an opportunity of observing the parts of the claw, and we now perceive that this conical substance is not a simple congeries of flesh. The moment is now arrived when the claw begins to be brought forth. The membrane at last bursts, and the new claw, though still soft, appears without encumbrance or investment. In a few days more it is covered with a shell; and though still delicate, and not the half of its former length, it is able to perform all the natural functions. It has likewise been discovered, that, whether the claw has been lopped off at the fourth articulation, or anywhere else, the animal in a short time recovers all that it had lost. The same reproduction takes place also in the horns; but, if the tail is cut off, the animal survives a few days only *.

308 in mollusca; Many of the mollusca exhibit curious instances of reproduction, especially the actinia, the star fish, and snails. The abbé Dicquemaire made several experiments to ascertain the reproductive power of the *actinia rufa* (purple sea anemony). He first cut off all its tentacula, which grew again in less than a month; and on repeating this a second and third time, he had equal success. He cut off the upper part of one, and a few days after, the base of the animal was found to have fallen from its place; but it soon entirely recovered its limbs. But if the base of these animals is injured by the incision, the wound commonly proves mortal. The arms of the star-fish are often torn off, but appear always to be reproduced. The power of snails in this respect is very great; for Spallanzani has ascertained, that even if their heads are cut off, these are regenerated in no very long time. There can scarcely be a more surprising instance of animal reproduction than this, as we shall readily allow, if we consider the complicated structure of the head of a snail; that it contains a brain divided into two parts; that the horns attached to it are furnished with muscles, and that on the tops of the larger horns there are eyes, composed of two coats and three humours; that the head contains a mouth, lips, teeth, and a palate; and yet all these parts, when cut away, have been reproduced in the course of a few weeks.

309 in polypes. On the reproductive power of polypes we have been sufficiently minute under HELMINTHOLOGY, N° 84.

310 Writers on the reproduction of parts. As this subject of partial reproduction is extremely curious, and as we cannot here enter upon any particular detail on the experiments and observations that have been made on the subject, we shall conclude this part of the present chapter by enumerating the principal works to which the reader may refer for a more satisfactory account of the subject. These are chiefly Trembley,

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* *Phil. Trans.* 1795, p. 177.

† *Jones's Treatise on Hæmorrhages*, &c.

* *Bingley's Animal Biog.* vol. iii.

bley, *Memoires sur les Polypes;* Bonnet, *Traité d'Insectologie, Palingenesie,* and *Considerations sur les Corps Organises,* vol. ii.; Reaumur, *sur les Insects;* Spallanzani, *Tracts on Animals and Vegetables,* and *Essay on Reproduction;* Hunter's *Treatise on the Blood,* &c.; Russel's *Practical Essay on Necrosis.* Moore *on the Healing Process;* Murray, *de Redintegratione Partium;* and the publications of Dr Jones and Mr Cruickshank already referred to. There is also a neat view of the principal facts relating to this subject in a thesis *De Vulnere Naturæ Sanándo,* published at Edinburgh in 1805, by Dr John Gordon.

311 Reproduction of the species by generation.

We have already stated it as our opinion, that plants, as well as animals, reproduce their like by generation. We shall not now enter on a discussion of the controverted point of the sexual system; and as the parts that appear subservient to this function in plants, and their various modes of propagation, have been sufficiently explained under the articles BOTANY and PLANT, we shall in this chapter confine our attention to the generation of animals.

312 Organs.

The human organs of generation are described in the article ANATOMY, sect. xv. those of the cetacea under CETOLOGY, N° 161.; those of birds under *Comparative* ANATOMY, 277: those of fishes have been noticed under ICHTHYOLOGY. For a more full comparative view of these organs, we refer to Cuvier and Blumenbach.

313 Nature of generation.

The nature of generation which is the greatest mystery in the economy of living bodies, is still involved in impenetrable obscurity. The only circumstance common to all generation, and consequently the only essential part of the process, is, that every living body is attached at first to a larger body of the same species with itself. It constitutes a part of this larger body, and derives nourishment, for a certain time, from its juices. The subsequent separation constitutes *birth,* and may be the simple result of the life of the larger body, and of the consequent developement of the smaller, without the addition of any occasional action.

Thus the essence of generation consists in the appearance of a small organized body in or upon some part of a larger one; from which it is separated at a certain period, in order to assume an independent existence.

All the processes and organs, which co-operate in the business of generation in certain classes, are only accessory to this primary function.

314 Gemmiparous generation.

When the function is thus reduced to the most simple state, it constitutes the gemmiparous, or generation by shoots. In this way the buds of trees are developed into branches, from which other trees may be formed. The polypes (hydra) see HELMINTHOLOGY, N° 84. and the sea anemones (actiniæ), multiply in this manner; some worms are propagated by a division of their body, and must, therefore, be arranged in the same division. This mode of generation requires no distinction of sex, no copulation, nor any particular organ.

315 Fecundation.

Other modes of generation are accomplished in appropriate organs; the germs appear in a definite situation in the body, and the assistance of certain operations is required for their further developement. These operations constitute *fecundation,* and suppose the existence of *sexual parts;* which may either be separate, or united in the same individual.

In most animals the embryo of the future young is fecundated within the peculiar organs of one individual, while another of the same species is provided with the means of giving activity to the embryo by a fecundating fluid. In some animals, however, both these offices are performed by the same individual, which is then said to be androgynous, or hermaphrodite.

316 Distinction of sexes.

The office of the male sex is that of furnishing the *fecundating* or *seminal fluid;* but the manner in which that contributes to the developement of the germ is not yet settled by physiologists. In several instances, particularly in the frog, the germ may be clearly recognized in the ovum before fecundation; its pre-existence may be inferred in other cases from the manner in which it is connected to the ovum when it first becomes visible; for it is agreed on all hands, that the ovum exists in the female before fecundation, since virgin hens lay eggs, &c.

317 Hermaphrodites.

The combination of the sexes and the mode of fecundation are subject to great variety. In some instances they are united in the same individual, and the animal impregnates itself. The acephalous mollusca and the echini exemplify this structure. In others, although the sexes are united in each individual, an act of copulation is required, in which they both fecundate, and are fecundated; this is the case with the gasteropodous mollusca and several worms. In the remainder of the animal kingdom the sexes belong to different individuals.

318 Modes of impregnation.

The fecundating liquor is always applied upon or about the germs. In many cases the ova are extruded before they are touched by the semen, as in some bony fishes and the cephalopodous mollusca. Here, therefore, impregnation is effected out of the body, as it is also in the frog and toad. But in the latter instances the male embraces the female, and discharges his semen in proportion as she voids the eggs. In most animals the seminal liquor is introduced into the body of the female, and the ova are fecundated before they are discharged. This is the case in the mammalia, birds, most reptiles, and some fishes; in the hermaphrodite gasteropodous mollusca, in the crustacea, and insects. In all the last-mentioned orders ova may be discharged without previous copulation, as in the preceding. But they receive no further developement; nor can they be fecundated when voided *. We shall not gratify the prurient imagination of the philosophic sensualist, by any details of the mode in which these operations are carried on in the various classes of animals, except in one instance, which is so curious that we shall be excused for describing it. We allude to the copulation of the snail.

319 Copulation of snails.

These animals meet in pairs, and stationing themselves an inch or two apart, launch several little darts, not quite half an inch long, at each other. These are of a horny substance, and sharply pointed at one end. The animals, during the breeding season, are provided with a little reservoir for them, situated within the neck, and opening on the right side. On the discharge of the first dart, the wounded snail immediately retaliates on its aggressor by ejecting at it a similar dart; the other again renews the battle, and in turn is again wounded. Thus are the darts of Cupid, metaphorical with all the rest of the creation, completely realised in snails. After the combat they come together. Each of them lays its eggs in some sheltered and moist situation,

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* *Cuvier Leçons d'Anat. Comp.* tom. v. p. 12.

tion, generally under a little clod of earth, or in some cool cavity †.

320 The effect of a single copulation varies in its degree: it usually fecundates one generation only; but sometimes, as in poultry, several eggs are fecundated; still, however, they only form one generation. In a very few instances one act of copulation fecundates several generations, which can propagate their species without the aid of the male. In the plant-louse (*aphis*) this has been repeated eight times; and in some *monoculi* 12 or 15 times.

321 **Oviparous generation.** When the germ is detached from the ovary, its mode of existence may be more or less complete. In most animals it is connected, by means of vessels, to an organized mass, and the absorption of which nourishes and developes it until the period of its birth. It derives nothing, therefore, from the body of the mother, from which it is separated by coverings varying in number and solidity. The germ, together with its mass of nourishment, and the surrounding membranes, constitutes an egg, or *ovum;* and the animals which produce their young in this state, are denominated *oviparous.*

In most of these the germ contained in the egg is not developed until that part has quitted the body of the mother, or has been *laid;* whether it be necessary that it should be afterwards fecundated, as in many fishes; or require only the application of artificial heat for its incubation, as in birds; or that the natural heat of the climate is sufficient, as in reptiles, insects, &c. These are strictly oviparous animals.

322 **Ovo-viviparous animals.** The ovum, after being fecundated and detached from the oviarum, remains in some animals within the body of the mother, until the contained germ be developed and hatched. These are *false viviparous* animals, or *ovo-viviparous.* The viper, and some fishes, afford instances of this process.

323 **Viviparous generation.** Mammalia alone are truly viviparous animals. Their germ possesses no provision of nourishment, but grows by what it derives from the juices of the mother. For this purpose it is attached to the internal surface of the uterus, and sometimes, by accident, to other parts, by a kind of root, or infinite ramification of vessels, called *placenta.* It is not, therefore, completely separated from the mother by its coverings. It does not come into the world until it can enjoy an independent organic existence. The mammalia cannot, therefore, be said to possess an *ovum* in the sense which we have assigned to that term.

From this view of the subject, generation may be said to consist of four functions, differing in their importance, and in the number of animals to which they belong.

1. The *production of the germ,* which is a constant circumstance; 2. *Fecundation,* which belongs only to the sexual generation; 3. *Copulation,* which is confined to those sexual generations, in which fecundation is accomplished within the body; 4. *Uterogestation,* which belongs exclusively to viviparous generation *.

There is a general rule observable among all quadrupeds, that those which are large and formidable produce but few at a time; while such as are mean and contemptible are extremely prolific. The lion, or tiger, have seldom above two cubs at a litter; while the cat, that is of a similar nature, is usually seen to have five or six.

324 **Comparative fecundity of animals.** In this manner, the low tribes become extremely numerous; and, but for this surprising fecundity, from their natural weakness, they would quickly be extirpated. The breed of mice, for instance, would have long since been blotted from the earth, were the mouse as slow in production as the elephant. But it has been wisely provided, that such animals as can make but little resistance, should have at least a means of repairing the destruction which they must often suffer, by their quick reproduction; that they should increase even among enemies, and multiply under the hand of the destroyer. On the other hand, it has as wisely been ordered by Providence, that the larger kinds should produce but slowly; otherwise, as they require proportional supplies from nature, they would quickly consume their own store; and, of consequence, many of them would soon perish through want; so that life would thus be given without the necessary means of subsistence. In a word, Providence has most wisely balanced the strength of the great against the weakness of the little. Since it was necessary that some should be great and others mean, since it was expedient that some should live upon others, it has assisted the weakness of one by granting it fruitfulness, and diminished the number of the other by infecundity.

In consequence of this provision, the larger creatures, which bring forth few at a time, seldom begin to generate till they have nearly acquired their full growth. On the contrary, those which bring many reproduce before they have arrived at half their natural size. Thus the horse and the bull are at their best before they begin to breed: the hog and the rabbit scarce leave the teat before they become parents in turn. Almost all animals likewise continue the time of their pregnancy in proportion to their size (L).

325 For an account of the principal phenomena attending the reproduction of the human species, viz. the requisites for conception and its signs; the effects of impregnation; the gradual evolution of the fœtus, and the successive changes that take place in the uterine system during uterogestation, see the article MIDWIFERY, chap. i. and ii. The phenomena of reproduction in other viviparous animals are so analogous to those in the human species, that we need not enter on an examination of them. We shall here only give a view of the successive changes that take place in the egg of birds during incubation, taken from the observations of the celebrated Blumenbach.

326 **Progressive changes of the chick during incubation.** The following observations refer to the egg of the common hen, as affording the most familiar example of incubation.

A small shining spot, of an elongated form, with rounded extremities, but narrowest in the middle, is perceived at the end of the first day, not in nor upon the

† *Shaw's Naturalist's Miscellany,* vol. i.

* *Cuvier,* lec. xxix.

(L) In the following table are noted the time of gestation, incubation, and the number of young produced in several species of quadrupeds and birds, as far as these have been ascertained; and the second column shews the period to which the life of each is usually extended.

the cicatricula (M), but very near that part on the yolk-bag. This may be said to appear before-hand, as the abode of the chick which is to follow.

327 Second day. No trace of the latter can be discovered before the beginning of the second day; and then it has an incurvated form, resembling a gelatinous filament with large extremities, very closely surrounded by the amnion, which at first can scarcely be distinguished from it. About

	Species.	Period of Life.	Time of Gestation.	Number of Young.
QUADRUPEDS.	Apes.	- - -	- - -	About 2.
	Bats.	- - -	- - -	From 2 to 5.
	Sloth.	- - -	- - -	One.
	Rhinoceros.	70 or 80 years.	- - -	One.
	Elephant.	Above 100 years.	21 months.	One.
	Arctic walrus.	- - -	9 months.	One.
	Seal.	- - -	- - -	About 2.
	Bitch.	12 or 16 years.	9 weeks.	From 4 to 10.
	Wolf.	- - -	3$\frac{1}{2}$ months.	5 or 6.
	Fox.	About 14 years.	6 weeks.	From 3 to 6.
	Jackall.	- - -	- - -	From 6 to 8.
	Lioness.	Above 70 years.	- - -	4 or 5.
	Tigress.	- - -	- - -	Ditto.
	Cat.	From 10 to 18 years.	8 weeks.	From 4 to 6.
	Ferret.	- - -	6 weeks.	6 or 7.
	Otter.	- - -	9 weeks.	4 or 5.
	Virginian opossum.	- - -	- - -	Ditto.
	Kanguroo.	- - -	- - -	One.
	Mole.	- - -	- - -	4 or 5.
	Porcupine.	- - -	- - -	Two.
	Guinea pig.	6 or 7 years.	3 weeks.	From 5 to 12.
	Common rat.	- - -	5 or 6 weeks.	From 12 to 18.
	Mouse.	From 2 to 3 years.	- - -	From 6 to 10.
	Common squirrel.	- - -	6 weeks.	From 4 to 5.
	Hare.	- - -	A month.	3 or 4.
	Rabbit.	- - -	Ditto.	About 8.
	Camel.	40 or 50 years.	12 months.	One.
	Rein deer.	15 or 16 years.	8 months.	Two.
	Stag.	Near 50 years.	5 months.	One.
	Goat.	- - -	Ditto.	About 2 or 3.
	Ewe.	15 years.	Ditto.	From 1 to 3.
	Cow.	- - -	9 months.	1 to 3.
	Mare.	30 or 40 years.	11 months.	1 or 2.
	Sow.	Nearly 20 years.	4 ditto.	From 10 to 20.
			Time of Incubation.	
BIRDS.	Eagle.	Above 100 years.	30 days.	2 or 3.
	Raven.	Near 100 ditto.	20 ditto.	5 or 6.
	Cuckoo.	- - -	- - -	1 or 2.
	Humming bird.	- - -	12 days.	Two.
	Blackbird.	- - -	14 ditto.	4 or 5.
	Canary bird.	10 or 20 years.	Ditto.	Ditto.
	Wren.	- - -	Ditto.	From 10 to 18.
	Pigeon.	- - -	Ditto.	Two.
	Turkey.	- - -	A month.	18 or 20.
	Hen.	About 13 years.	3 weeks.	About 20.
	Ostrich.	- - -	6 weeks.	One or two each.
	Swan.	Above 100 years.	Ditto.	6 or 8.
	Goose.	Near 100 years.	A month.	9 to 12.
	Duck.	- - -	Ditto.	12 to 14.

(M) The structure of an egg has already been described under the article EGG; but for the better understanding of Blumenbach's observations, it may be necessary to enumerate the several parts, with the names given to them by that author. The membrane lining the shell is called *membrana albuminis*, and includes the two whites of the egg, the inner of which surrounds the yolk, which is contained within a peculiar, very delicate membrane, called the *yolk-bag*. From two opposite sides of this bag proceeds a white knotty body, terminating in the white of the egg, by a flocculent extremity. These bodies are called the *chalazæ* or *grandines*; the *cicatricula*, tread, or traddle, is surrounded by one or more whitish concentric circles called *halones*, or *circuli*, the use of which is not known.

About this time the halones enlarge their circles; but they soon after disappear entirely, as well as the cicatricula.

The first appearance of red blood is discerned on the surface of the yolk-bag, towards the end of the second day. A series of points is observed, which form grooves; and these closing, constitute vessels, the trunks of which become connected to the chick. The vascular surface itself is called *figura venosa*, or *area vasculosa*; and the vessel by which its margin is defined, *vena terminalis*. The trunk of all the veins joins the *vena portæ*; while the arteries, which ramify on the yolk-bag, arise from the mesenteric artery of the chick.

328 Third day. On the commencement of the third day, the newly formed heart is discerned by means of its triple pulsation, and constitutes a threefold *punctum saliens*. Some parts of the incubated chicken are destined to undergo successive alterations in their form; and this holds good of the heart in particular. In its first formation it resembles a tortuous canal, and consists of three dilations lying close together, and arranged in a triangle. One of these, which is properly the right, is then the common auricle; the other is the only ventricle, but afterwards the left; and the third is the dilated part of the aorta.

About the same time, the spine, which was originally extended in a straight line, becomes incurvated; and the distinction of the vertebræ is very plain. The eyes may be distinguished by their black pigment, and comparatively immense size; and they are afterwards remarkable in consequence of a peculiar slit in the lower part of the iris.

329 Fourth day. From the fourth day, when the chicken has attained the length of four lines, and its most important abdominal viscera, as the stomach, intestines, and liver, are visible, (the gall-bladder, however, does not appear till the sixth day), a vascular membrane begins to form about the navel; and increases in the following days with such rapidity, that it covers nearly the whole inner surface of the shell, within the *membrana albuminis*, during the latter half of incubation. This seems to supply the place of the lungs, and to carry on the respiratory process instead of those organs. The lungs themselves begin indeed to be formed on the fifth day; but, as in the fœtus of the mammalia, they must be quite incapable of performing their functions while the chick is contained in the amnion.

330 Sixth day. Voluntary motion is first observed on the sixth day, when the chick is about seven lines in length.

331 Ninth day. Ossification commences on the ninth day, when the ossific juice is first secreted, and hardened into bony points. These form the rudiments of the bony ring of the sclerotica, which resembles at that time a circular row of the most delicate pearls.

At the same period, the marks of the elegant yellow vessels on the yolk-bag, begin to be visible.

332 Fourteenth day. On the fourteenth day the feathers appear; and the animal is able to open its mouth for air, if taken out of the egg.

333 Nineteenth day. On the nineteenth day it is able to utter sounds; and on the twenty-first to break through its prison, and commence a new life.

Blumenbach concludes his observations with a few remarks on those very singular membranes, the yolk-bag and the chorion, which are so essential to the life and preservation of the animal.

334 Remarks on the chorion. The chorion, that most simple yet most perfect temporary substitute for the lungs, if examined in the latter half of incubation in an egg very cautiously opened, presents, without any artificial injection, one of the most splendid spectacles that occurs in the whole organic creation. It exhibits a surface covered with numberless ramifications of arterial and venous vessels. The latter are of a bright scarlet colour, as they are carrying oxygenated blood to the chick; the arteries, on the contrary, are of a deep or livid red, and bring the carbonated blood from the body of the animal. Their trunks are connected with the iliac vessels; and, on account of the thinness of their coats, they afford the best microscopical object for demonstrating the circulation in a warm-blooded animal.

335 On the yolk-bag. The other membrane is also connected to the body of the chick; but by a two-fold union, and in a very different manner from the former. It is joined to the small intestine, by means of the *ductus vitello-intestinalis*, and also by the blood-vessels, with the mesenteric artery and vena portæ.

In the course of the incubation the yolk becomes constantly thinner and paler, by the admixture of the inner white. At the same time innumerable fringe-like vessels with flocculent extremities, of a most singular structure, form on the inner surface of the yolk-bag, opposite to the yellow ramified marks, and hang into the yolk. There can be no doubt that they have the office of absorbing the yolk, and conveying it into the veins of the yolk-bag, where it is assimilated to the blood, and applied to the nutrition of the chick. Thus in the chick which has just quitted the egg, there is only a remainder of the yolk and its bag to be discovered in the abdomen. These are completely removed in the following weeks, so that the only remaining trace is a kind of cicatrix on the surface of the intestine *.

Many of the causes which contribute to the formation of a living body have hitherto eluded human research; may in all probability never be discovered; and perhaps are beyond human comprehension.

336 Theories of generation. Some philosophers, discovering the extreme divisibility of matter, and learning from the microscope that transformation is but the developement of certain parts that previously existed, have thence imagined that generation is somewhat analogous; that all organised bodies received their form at the beginning; that the first of every genus and species contained by involution the numberless millions of succeeding generations; and that the union of the two sexes gives only a stimulus, and brings into view forms that had existed since the world began.

337 Hypothesis of successive evolution.

338 Objections. By this hypothesis they have attempted to explain a thing that is unknown, by what must remain for ever incomprehensible to the human mind in its present state. They absurdly appeal from observation to conjecture; and suppose that bodies which are originally brought into view, which are daily augmented, frequently repaired, and sometimes renewed by organic action, do nevertheless in their first formation require an effort superior to what omnipotence is able to perform by secondary agents. Had the supporters of this hypothesis considered that many herbaceous plants produce new flowers

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* Blumenbach's Comp. Anat. chap. xxvi.

when the first set are untimely cut off; that lobsters and many other animals renew their limbs, and that certain polypes can raise a structure so perfectly resembling a vegetable form as to puzzle the naturalist whether or not he should class them under plants, they would surely not have prescribed such bounds to omniscient wisdom and almighty power, or declared with such confidence what the Author of nature, to speak with the vulgar, must necessarily perform by his own hands, or what he may intrust to secondary causes regulated by his laws.

These philosophers will find it difficult to account in a very satisfactory manner for monstrous productions, and for those changes of structure and of form which for a while continue hereditary from the influence of habit. They object to others, that all the parts of a living body are mutually dependent on one another, and that they must necessarily have been coeval, or have existed at once. But though every attempt that has yet been made to ascertain which of the vital organs are prior and which posterior in a living body has proved unsuccessful, it has not been demonstrated that either themselves or their functions are coeval. It may, on the contrary, be plainly demonstrated from observation, that the lungs and the stomach do not begin to perform their functions so early as the heart and the vascular system; that even the heart and its system perform their functions with some considerable changes, immediately after birth; that the vegetable tribes are without nerves; and that the brain and nerves in the animal kingdom perform more and more of their functions, according as the system approaches towards maturity. It has even been shewn, that bones will unite; that the limbs of an animal continue to be nourished without the nerves; that there is a principle of life in the blood; that the heart will act under other stimuli beside that of nervous influence; and sound logic does by no means require us to suppose, that the first action of the fœtal heart, or the *punctum saliens*, is owing to the influence of stimuli from the brain, or that the brain must have existed when the heart first moved. Although the minuteness and transparency of the parts may prevent us from seeing the first gradual formation of the embryo, yet every observation corroborates the opinion, that it is formed by secondary causes, and through the medium of organic powers.

339 **Hypothesis of Epigenesis.**

Most physiologists have believed that certain inorganic particles are contained in the system of one sex or of the other, and that by the union of the sexes these particles have become organized. It has, however, been asked whether or not is the embryo formed by the joint operation of the two sexes? or is it formed entirely by one, and brought into action by a stimulus from the other? The former of these questions supposes that each of the sexes has a seminal fluid; that some mixture takes place in the uterus, and produces an embryo, in the same manner that a neutral salt assumes a certain and determinate form. The notion implies some general and confused ideas of chemical combination: but does not bespeak a very clear understanding, profound reflection, or much acquaintance with the nature and properties of living bodies.

For a long time past the most rational physiologists have generally thought that the embryo is formed gradually and slowly in one or other of the two sexes, not by chemical combination, but a system of organs directed by laws and prompted by stimuli, with many of which we are yet unacquainted. From the great Hippocrates to Fabricius and Harvey, the credit of furnishing the fœtal embryo was almost universally given to the females of oviparous animals. Among the viviparous, the appearances were such, that the female was left to contest it with the male.

340 **Embryo supposed to be derived from the male.**

At last the eclat of Leeuwenhoeck's discoveries seemed to put an end to all doubts entertained upon the subject. He very plainly saw through his microscope that very great profusion of particles that move to and fro with amazing rapidity in the male semen. Upon this he embraced the doctrine of Hamme, who had seen them before, and supposed from their motions that these particles were not only animalcules, but the principles or rudiments of that animal in whom they were formed, and that they were deposited in the uterus of the female only to be nourished and augmented in size.

341 **Objections.**

What raised objections against this theory was, that numerous animalcules were discoverable by the microscope in other fluids, and that a vast profusion of young embryos appeared in cases where never more than one or two arrive at maturity. It was an objection to it, that some females had been impregnated, where the hymen remained unbroken, so that the impregnating fluid could have reached only the mouth of the uterus. Again, in frogs, fishes, and many other animals, the ova are not impregnated till after extrusion; and lastly, Haller had observed the chick completely formed in eggs that had not been fecundated.

It is now, we believe, pretty generally known, that the embryo does not commence its existence in the cavity of the uterus. De Graaf observed it on its passage down the fallopian tube; he saw the place where it first began in the ovarium of the female, and cases have occurred where it has missed the fallopian tube, where it has fallen into the abdomen, in which the placenta has been formed, and the fœtus has grown among the bowels.

342 **More probable that the embryo exists in the female.**

From these facts it has been concluded, notwithstanding some feeble objections, that the female ovaria contain the embryos in the form of eggs; that these eggs are brought into action by the stimulating power of the male semen, which is sometimes thrown into the cavity of the uterus, sometimes applied only to its mouth, and sometimes sprinkled on the eggs after they are extruded. For more on this subject see the article MIDWIFERY.

343 **Relations.**

A view of the relations between the present function and those which we have before examined, is a subject of so delicate a nature, that we must not enlarge on it. The sympathy between the reproductive and the nervous systems is well known. The effect which desire has occasionally produced on the brain is very great, madness being not unfrequently the consequence, either of too much indulgence, or of total continence. We are of opinion that the influence of the fancy or imagination on the uterine system has been overrated, though the accounts given of monsters or deformed births, in consequence of terror experienced by the mother, appear to be too well authenticated to warrant our total disbelief in this influence. Too much indulgence in this appetite produces a debilitated state, both of the mental and bodily functions, and deprives the system of that natural stimulus which seems essential to the activity and vigour of the body in the male.

Chap. XV. *Of Sleep and Torpor.*

344 Necessity of sleep.

We have already considered the active means by which the waste of the body is repaired; but all these would have little effect, and could not indeed be carried on for any considerable time, without some general relaxation of the system. This relaxation is brought about by sleep, in which the active functions find a repose from the labours which they have undergone during the day; and in this way the system is recruited more completely than by any other means.

345 Sleep, an affection of mind.

Sleep may be considered as an affection of mind, and therefore more properly a subject of metaphysical, than of physiological speculation. It is, however, generally treated of in systems of physiology; and it will be necessary to take notice of some circumstances respecting it. We shall chiefly consider the state of the body and mind during sleep, and some of the principal theories that have been contrived to account for it.

346 Phenomena of sleep.

Natural sleep returns at certain intervals, which are, however, different in different animals. Most animals, and especially man, sleep only during the night, but most of the predacious species, as beasts and birds of prey, choose this time for their predatory excursions, and repose during the day. Sleep comes on with an unusual languor and lassitude; an aversion to motion; the mind becomes unfit for its usual exertions; and the desire of rest pervades the whole system. In particular, the extensor muscles lose their power of preserving the body in an erect posture; the eyelids involuntarily fall; the head bows forward; the joints bend, and the body sinks. During sleep, all the voluntary motions are in general suspended; but the involuntary actions of the heart and lungs proceed, though not so vigorously as in the waking state; the circulation and respiration being slower than usual. Most of the senses are also in a state of repose, especially those of feeling, smell, and probably of taste. Hearing is, in some animals, very acute during sleep, and they are thus enabled to escape any danger that threatens them. Some animals, as the hare, also sleep with their eyes open; and in most the impression of light, when the eyelids are raised, is very evident. The functions of digestion, absorption, and secretion, seem to proceed with greater ease and activity during sleep; and assimilation and nutrition are much promoted by this state of repose. Some of the faculties of the mind, especially the imagination, are, however, in full vigour, as appears from the dreams that take place during sleep. The duration of sleep is exceedingly various. Among the human species, young children, and very old persons, pass the greatest half of their time in sleep, while middle-aged and active people seldom sleep so much as one-third of the 24 hours.

Though the returns of sleeping and waking depend much on custom, they may, however, be changed by various circumstances; and though the commencement of one of these periods happen to be altered, that of the other may remain as before. If a person is accustomed to go to sleep exactly at nine in the evening, and to rise again at six in the morning, though the time of sleep may be occasionally protracted till twelve, he will yet awaken at his usual hour of six: or if his sleep be continued by darkness, quietness, or similar causes, till the day be farther advanced, the desire of sleep will return in the evening at nine.

347 Theory of sleep.

Most of the causes that produce or prevent sleep, have been mentioned in the article Medicine, N° 94. As to the immediate cause, the opinions of physiologists are much at variance, and the theory of sleep is as little understood as that of any function of the animal economy.

348 Hypothesis of Haller.

According to Haller, sleep arises, either from a simple absence, deficiency and immobility of the spirits, or from compression of the nerves, and always from the motion of the spirits through the brain being impeded *. That sleep is, some how or other, connected with a compression of the brain, appears very probable, from the heaviness and coma that take place in cases where such a compression has evidently been produced; but how this compression acts has never yet been satisfactorily explained; and the obstruction that Haller supposes in the motion of the animal spirits, or nervous fluid, is gratuitous.

349 Of Brown.

One of the fashionable doctrines of the present day respecting the immediate cause of sleep is, that this state is produced by an exhaustion of irritability or excitability. According to Brown, sleep succeeds a diminution of excitement, during which the excitability is either only so far diminished that it can be accumulated again, or so abundant, that the excess can be wasted, and in each case the excitement restored †.

350 Of Darwin.

Similar to this is the doctrine of Zoonomia, that sleep depends on an exhaustion of sensorial power. Dr Darwin thus characterizes perfect sleep: 1. The power of volition is totally suspended. 2. The trains of ideas caused by sensation proceed with greater facility and vivacity; but become inconsistent with the usual order of nature. The muscular motions caused by sensation continue; as those concerned in our evacuations during infancy, and afterwards in digestion, and in priapismus. 3. The irritative muscular motions continue, as those concerned in the circulation, in secretion, and respiration. But the irritative sensual motions, or ideas, are not excited; as the immediate organs of sense are not stimulated into action by external objects, which are excluded by the external organs of sense; which are not in sleep adapted to their reception by the power of volition, as in our waking hours. 4. The associate motions continue, but their first link is not excited into action by volition, or by external stimuli. In all respects, except those above mentioned, the three last sensorial powers are somewhat increased in energy during the suspension of volition, owing to the consequent accumulation of the spirit of animation ‡.

Thus, the immediate cause of sleep consists in the suspension of volition produced by the exhaustion of sensorial power; and hence, whatever diminishes the general quantity of sensorial power, acts as a remote cause of sleep.

Beside the insufficiency of these hypotheses to account for many circumstances that take place during sleep, we may remark, that this state is often produced when no exhaustion of irritability, excitability, or sensorial power, can be supposed to have taken place. Thus, the propensity to sleep often becomes irresistible from the effects of monotonous speaking, from stillness, darkness, or from the sameness of the scenery around us; and when one stimulus, after long application, can arouse no more, another stimulus that in ordinary cases is less powerful, produces excitement, and keeps off sleep; an evident proof that excitability or sensorial power have not been very far exhausted.

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* First Lines of Physiology, § 585.

† Elem. Med. § 337.

‡ Darwin's Zoonomia, vol. i. § 18.

351 **Supposed sleep of plants.** Plants have been said to sleep. At the approach of night, many of them are observed to change their appearances very considerably, and sometimes even to such a degree as scarcely to be known for what they are. These changes happen principally to the leaves and the flowers. During the night, many leaves, according to the nature and genus of the plant, are seen to rise up, to hang down, or to fold themselves in various ways, for the protection of the flowers, the buds, the fruits, the young stems; and many flowers, to escape a superabundance of moisture, to hang down their mouths towards the earth, or to wrap themselves up in their calices. These phenomena are owing to stimuli acting from without; we may add, that most of the motions are performed at the joints where the leaves and petals articulate with the stem. A period of rest is as necessary to plants as sleep is to animals. The irritable principle cannot act long under the influence of the same stimulus, except at intervals, and the rapid growth observable in plants during the night, is a strong proof that the organs employed in assimilation had been disturbed in discharging their functions during the day, when exposed to the action of heat and light and of other stimuli.

352 **Dreaming.** In our general outline, we had proposed introducing here an account of the phenomena of dreams, but we find that this subject has been so fully discussed under the article Dream, that any additional remarks would be unnecessary. To this article therefore we refer the reader.

Rules for the management of the body with respect to sleep, scarcely come within our present province; but as we pass so much of our time in this state, during which we are sometimes occupied in a very agreeable manner, while at others we are subject to most uneasy sensations, it is a matter of considerable consequence to take those measures which may secure to us the former, and enable us to avoid the latter. We have seen few rules better adapted to those purposes than those of Dr Franklin; but as more important matter presses for insertion within the circumscribed limits to which we are restricted, we must refer our readers to the original paper, which is published in the late 8vo edition of *Franklin's Works*, vol. iii. p. 437.

353 **Somnambulism.** In a few cases, not only the imagination has a full range during sleep, but the voluntary motions of the body, and even the exercise of some of the external senses, are carried on with apparently as much perfection as when the person is awake. This state is called *somnambulism*, or sleep-walking, and is commonly considered as a variety of dreaming. Many surprising accounts have been given of sleep-walkers. They have been known to rise, dress themselves, go out of doors, and sometimes out of a window, from which they have climbed upon the roof of a house, dig in a garden, draw water from a well, saddle a horse and ride several miles; maintain a rational and interesting conversation, and even go through a laborious and difficult literary task; and after having performed these exploits, they have returned to their bed without being conscious of what they had been doing. This want of consciousness appears from their remembering nothing when they awake, of what passed during their sleep. It is disputed whether somnambulists incur as much danger in the actions which they perform, as those who are awake, in similar circumstances. We are inclined to think that the danger is much less in the former case, as sleep-walkers seem entirely free from the terror which commonly attends the attempting of any hazardous enterprise when awake; such as mounting to the roof of a house, climbing a steeple, &c. If suddenly awaked, however, while engaged in any of their hazardous actions, the danger is very great.

354 **Reverie.** Dr Darwin considers somnambulism, not as a state of sleep or dreaming, but as a variety of reverie, carried to a morbid extent, so as to become a sort of epileptic or cataleptic paroxysm. In the state of reverie, according to Dr Darwin, the irritative motions occasioned by internal stimuli continue, those from the stimuli of external objects are either not produced at all, or are never succeeded by sensation or attention, unless they are at the same time excited by volition; the sensitive motions continue, and are kept consistent by the power of volition; the voluntary and associate motions continue undisturbed. He considers reverie as an effort of the mind to relieve some painful sensation, whence it is allied to convulsion and insanity *.

355 **Torpor of animals.** The torpor that takes place in many animals during winter, appears to be so nearly allied to sleep, that we shall consider it in this chapter.

A great variety of animals of almost every class, retire during the cold of winter, to the recesses of caverns, holes in old walls, hollow trees, or below the earth, where they remain in apparently a lifeless state till the return of spring rouses them from their trance. We shall here enumerate the different animals that have been known to undergo this state of hibernation.

356 **Hibernating mammalia.** *Bats*, especially the *vespertilio murinus*, *auritus*, and *v. noctula* (see Mammalia, N° 39.); *bears*, especially the brown and the polar bear, and the badger; the *hedgehog*, (*erinaceus Europeus*); several species of the mouse and rat tribe, but more especially the *hamster* (*mus cricetus*), the *marmots*, especially the *arctomys marmota*, (see Mammalia, N° 124.); the *dormouse* (*myoxus muscardinus*). Sheep appear capable of living for a considerable time in a torpid state, as they have been known to remain alive for several weeks, buried under the snow.

357 **Hibernation of birds;** It does not appear that birds in general are capable of undergoing this state of existence; but the instances of swallows that have been found in this state in old walls and hollow trees, and even, as some affirm, below water, and have recovered life and activity on being exposed to gradual warmth, are too well authenticated to admit a doubt, that these at least sometimes hibernate.

358 **of reptiles and serpents;** Most reptiles and serpents pass the winter in a state of hibernation; but this is more particularly the case with the land tortoise (*testudo græca*) see Erpetology, p. 271.; frogs, and those lizards which inhabit cold climates.

359 **of fishes;** It is not certainly known whether many species of fish become torpid in winter; but there is no doubt that several of them are susceptible of this state *; and we are told that in North America, especially about Hudson's

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* *Zoonomia*, vol. i. § 19.

* *Reeve Dis. Inaug. de Animalibus Hiemesopitis*, p. 10.

bay, fishes are not unfrequently found included within a body of ice, and when exposed to gentle heat, have recovered life and motion.

360 Of insects.

Almost all insects remain, during the winter, in a torpid state. This happens principally to the crysalids, and such grubs as cannot, in that season, procure their food.

361 Of man.

It will appear extraordinary that we should place man among the hibernating animals; and yet there seems little doubt, that even he is capable of having his life suspended for a considerable time, when exposed to those causes which bring about the torpidity of those animals that we have already mentioned. We are told of a woman, who, in February 1789, remained eight days buried in the snow, and still recovered; and the case of the three women who remained for 37 days in a stable at Bergamoletto, that had been overwhelmed by an *avalanche*, or snow heap, with no other sustenance than the milk of a half-starved she goat, is well known. These instances, added to others of persons who have passed several weeks in a state of almost uninterrupted sleep, tend to prove that man himself may, under certain circumstances, continue in a torpid state.

362 Principal phenomena of hibernation.

During this state of torpidity, the animals scarcely appear to live; sensation seems altogether lost; their irritability is so much diminished, that they may be cut, torn, or even broken to pieces, without expressing any mark of feeling, or giving any sign of motion; digestion seems entirely suspended; the secretions and excretions are discontinued. Some of the functions, however, are carried on. Respiration and circulation, though very languid, and sometimes scarcely perceptible, appear to go on in a degree sufficient to preserve the existence of the animal; and the action of the absorbents seems to be very little diminished, as appears from the gradual absorption of the fat. If the animal is taken from its place of confinement, and exposed to a gentle heat, it gradually recovers all its faculties; but if carried back to its cell, it relapses into the state of torpidity.

363 Suspended animation of some animals.

The long suspension of animation, of which several animals are susceptible, appears still more extraordinary than the torpidity above described. The common hair worm (*gordius aquaticus*) may, when dried, be preserved for an indefinite length of time, and when put into water, gradually recovers its usual activity of motion. See HELMINTHOLOGY, N° 32. One of the most remarkable cases of this suspended animation is that related of the garden snail, of which the following curious account has been given in the Philosophical Transactions for 1774. Mr Stuckey Simon, a merchant in Dublin, whose father, a fellow of the Royal Society, and a lover of natural history, left to him a small collection of fossils and other curiosities, had amongst them the shells of some snails. About 15 years after his father's death (in whose possession they were many years), he by chance gave to his son, a child about 10 years old, some of these shells to play with. The boy put them in a flower-pot, which he filled with water, and the next day into a bason. Having occasion to use this, Mr Simon observed that the animals had come out of their shells. He examined the child, who assured him that they were the same he had given him, and said he had also a few more, which he brought. Mr Simon put one of them into water, and in an hour and a half after observed that it had put out its horns and body, which it moved but slowly, probably from weakness. Major Vallancy and Dr Span were afterwards present, and saw one of these snails crawl out, the others being dead, most probably from their having remained some days in the water. Dr Quin and Dr Rutty also examined the living snail several times, and were greatly pleased to see him come out of his solitary habitation after so many years confinement. Dr Macbride, and a party of gentlemen at his house, were also witnesses of this surprising phenomenon. Dr Macbride has thus mentioned the circumstance: "After the shell had lain about ten minutes in a glass of water that had the cold barely taken off, the snail began to appear; and in five minutes more we perceived half the body pushed out from the cavity of the shell. We then removed it into a bason, that the snail might have more scope than it had in the glass; and here, in a very short time, we saw it get above the surface of the water, and crawl up towards the edge of the bason. While it was thus moving about, with its horns erect, a fly chanced to be hovering near, and, perceiving the snail, darted down upon it. The little animal instantly withdrew itself into the shell, but as quickly came forth again, when it found the enemy was gone off. We allowed it to wander about the bason for upwards of an hour, when we returned it into a wide-mouthed phial, wherein Mr Simon had lately been used to keep it. He was so obliging as to present me with this remarkable shell; and I observed, at twelve o'clock, as I was going to bed, that the snail was still in motion, but next morning I found it in a torpid state, sticking to the side of the glass."

The still more extraordinary instances that have been related, on what many have considered authentic testimony, of toads having been found inclosed in the trunk of a large tree, or within a solid block of stone, appear almost incredible; and yet if we consider that M. Herissant preserved toads in a state of suspended animation for 18 months, in boxes covered with a thick coating of mortar (see ERPETOLOGY, p. 286.); that the snails mentioned in the above quotation, must have lain for at least 20 years; and that flies have been recovered after being immersed for many months in Madeira wine, it is difficult to say how long this suspended animation may not be continued.

364 Hibernation of plants.

Similar phenomena take place in the vegetable creation. Most of those plants which survive one year, shed their leaves on the approach of winter; and, during this season, the motion of the sap ceases, and they have all the appearance of dead shrubs. The herbaceous tribes even die down to the roots, which, being mostly of the bulbous kind, afford shelter to the surviving germ; and are hence called, by botanists, the *hybernacula* of plants. On return of spring, the plant shoots anew from its winter's retreat, and flourishes with its former strength and beauty.

Some plants are even capable of having their vitality, or rather the exercise of all their functions, suspended, as in the *gordius* and the snail, for an indefinite length of time. *Mosses* have been kept in a dried state in a *hortus siccus* for many years, and have shown no sign of life, till they were moistened and exposed to air, light, and a moderate heat, when they have recovered all their powers, have erected their stems, shot forth new branches, and flourished as at first.

365 Theory of torpor.

It is almost impossible, in the present state of our physiological knowledge, to give any rational theory of these phenomena. The torpor of animals has been attributed to exhausted excitability, or exhausted sensorial power; to the effects of habit, and to the effect produced on the brain by suspended or diminished respiration. The last of these, though not quite satisfactory, appears to us the most probable hypothesis. It has been ably defended and illustrated by Dr George Kellie, in a paper in which he relates a remarkable case of torpor from cold.

"The powers of voluntary motion and of sensation (says Dr Kellie), are known to depend immediately upon the conditions of the brain and nerves; if, therefore, we could discover in what manner these organs are affected by any of the preceding events, we should advance considerably towards the solution of the questions above stated. (*Namely, What is the order of succession between the diminished irritability of the heart, in consequence of the abstraction of caloric, and the complete torpor of the voluntary muscles and of the organs of sense, and how are the intervening effects connected?*) Were the inactivity of these organs the direct effect of their diminished temperature; did the torpor in no case happen, till the heat of the brain and nerves was reduced beneath the natural standard, there could be hardly ground for any farther inquiry. But, as it is not so, some other change, less direct, must have occurred, in consequence of the connection of the brain with, and its dependence upon, some other of the functions antecedently and more immediately affected; and this function I apprehend to be respiration, between which and the energies of the nervous system a very intimate connection is maintained, through the changes produced on the blood during the pulmonary circulation. This dependence of the brain upon the properties of the blood, maintained by respiration, is evinced by a great variety of observations. Whatever impedes the respiratory changes of the circulating fluid debilitates or destroys the powers of muscular motion, as the respiration of noxious gases, of reduced or rarefied atmosphere; while greater exertions of muscular powers call for, and give occasion to more frequent respiration, more rapid consumption of air, and greater changes of the blood; and the breathing of more effective gases, as of the nitrous oxide, increases the motive and sensitive powers of animals. That these effects depend immediately upon the properties of the blood, as modified by respiration, acting on the brain, has, I think, been proved by the experiments of Bichat, who, in a masterly manner, has traced the mutual connection and dependencies of the vital functions in his admirable *Recherches Physiologiques sur la Vie et la Mort*. The transfusion or injection of venous blood into the carotids induced asphyxia or death, the instant it reached the brain; an effect which did not follow the similar transfusion of arterial blood from the carotid of another*. By these experiments, and by several other observations, he has shewn, that the asphyxia which so instantly follows impeded or suspended respiration is occasioned by the impression of dark, venous, unchanged blood upon the brain, and not, as has commonly been supposed, from this blood being incapable of stimulating the left side of the heart, which, on the contrary, continues to contract and to circulate the blood for some time after the voluntary functions are suspended; an observation confirmed also by Coleman and others.

"Such then appears to be the connection between the functions of respiration and those of the brain. Now, in animals rendered torpid from cold, there are many observations which lead us to believe, that the immobility of the nervous system depends much, and very directly too, on the state of respiration.

"In the perfect torpor of the hibernating *amphibiæ*, respiration is completely suspended, and the consequent changes produced on the blood by that function totally prevented. This, which appeared from a variety of observations on the winter quarters of such animals found imbedded in mud, incased in ice, or closed up in opercula of their own construction, for the occasion of excluding the air, has been amply confirmed by the pointed experiments of Spallanzani, lately published by Senebier †.

"In every case of torpor from cold, where the respiration falls short of this complete suspension, it is at least more or less impaired. How much the torpid state depends on this condition of the respiratory functions, farther appears from observing, that hibernating animals, even those not of the amphibious order, warned by the approach of winter, instinctively or industriously seek situations unfavourable to perfect respiration, where this function may be either inadequately or not at all performed, as by premature and involuntary interment under ground, in old walls, in mud at the bottom of lakes, &c. The instinct of these animals, too, has been finely imitated by experiment, illustrating at once the object of this instinct, and confirming the opinion here advanced of its tendency. Thus the dormant hamster was found to regain and preserve its activity, when freely exposed to a pure atmosphere, the temperature, at the same time, not exceeding that at which it had formerly become torpid, or at which it returned to that state when again secluded under ground ‡. These observations seem conclusive on this point, and, with those already brought forward confirming the general connection established between the properties of the blood, as modified by respiration, and the functions of the brain, render it, I think, highly probable, that the torpor of the voluntary powers, in the cases now under consideration, is the consequence of a limited and imperfect respiration, antecedently induced by diminished temperature.

"Observation, indeed, is more deficient on this point with regard to the higher order of animals, and to men, who only occasionally become torpid from cold. Yet more than analogy, which is here very strong, leads me to believe that, even in these, the functions of respiration are much and necessarily affected. The examples of cattle and of men remaining long torpid, deeply buried under snow, are pretty direct and convincing proofs of this.

"If our induction from all these observations be admitted, we have the rudiments of a theory adequate to the explanation of the phenomena, in so far, at least, as the torpor of the voluntary powers is concerned.

"From the suspended or imperfect respiration, those changes, by which the blood is fitted for maintaining the activity of the sensorial system, are interrupted; this imperfect blood circulating slowly through the brain directly impedes its functions, and so debilitates the excitability of the motive and sensitive organs, that they become torpid. This enunciation may seem hypothetical; but let the proofs of the intimate connection between the respirable and sensorial functions be weighed;

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* *Bichat, Recherches*, part ii. art. 7.

† *Mem. on Respiration.*

‡ *Buffon's Nat. Hist.* by Smellie, vol. vii. p. 193.

consider also the interrupted respiration of hibernating and torpid animals, their instincts with regard to this, and the greater facility with which torpor is induced in a confined situation, which they naturally seek; and compare all these with the observations and experiments of Bichat on the effects of the immediate impression of venous blood upon the brain, and you will perceive a connected system, not entirely fanciful, a theory not without foundation and strength, and which appears to me at least to merit some attention *."

For further particulars respecting the torpidity or hibernation of animals, we refer the reader to Spallanzani's *Tracts on Animals and Vegetables;* White's *Natural History of Selborne;* Barton's *Fragments of the Natural History of Pennsylvania;* Pennant's *Arctic Zoology;* La Cèpede *on Oviparous Quadrupeds, as translated by Kerr;* Townson's *Tracts on Natural History and Physiology,* and the *Inaugural Dissertation of* Dr Reeve *de Animalibus Hieme Sopitis,* published at Edinburgh in 1803.

CHAP. XVI. *Of Death.*

366 IN the article MAN, (N° 33. *to the end*) we have traced the progress of human life, from the *cradle* to the *grave;* and have briefly considered the phenomena and the consequences of natural *death*. In that article, and LONGEVITY, we have also stated the natural duration of human life, and the circumstances that tend to prolong our existence beyond the ordinary period. We shall not here enter again on any of these topics, except to give a more ample account of the gradual approaches of natural death, and shall then enumerate the causes which usually produce *violent* or *accidental* death, and mention the opinions of some of the best writers on the *nature* of death.

367 Gradual approach of natural death.

Natural death is, in the present state of civilized society, by no means a common occurrence. When it does take place, its approach is slow and gradual. He whose life terminates in consequence of advanced age, (to use the language of a celebrated French physiologist), dies in detail. His external functions successively cease to exert their action; all his senses are successively lost, or the ordinary causes of sensation pass over them without leaving their usual impressions. The *sight* becomes obscure, and at length the humours of the eye no longer transmit the rays of light; the *ear* receives only confused sounds, and frequently before death, is altogether insensible; the sense of *touch*, in consequence of the hardness and callousness of the cuticle, and the obliteration of many of the subcutaneous vessels, grows dull and uncertain; and all the parts depending on the skin show marks of weakness; the hair and the beard grow white, and a greater or less degree of baldness takes place; odours are no longer perceived, or they are perceived but faintly. The taste usually survives the rest of the senses; but that too, at last, grows equally obscure. The functions of the brain partake of the imbecility of the external senses. The imagination in particular becomes dull and often depraved; the memory no longer retains those occurrences which are every day taking place, though it recalls with increased relish and delight those of past times; the judgment becomes weak and wavering.

From the universal agency exerted by the nervous system on all the animal functions, we must expect that when the former is impaired, the latter will be proportionally enfeebled. The faculties of locomotion and of speech are commonly the first of these that fail; the body totters at every step, the voice grows weak, and the tongue faulters. The motion of the limbs is difficult and painful, and hence is but seldom willingly exerted. Not so with the vocal organs, though the impediments to utterance are evident and painful to his hearers, the old man himself seems scarcely to attend to them, but talks with proverbial garrulity, and especially delights in recounting the scenes and actions of his youth.

While the external functions, and those of the brain, are thus gradually impaired; the internal, or what are commonly called the vital and natural functions, as digestion, absorption, circulation, respiration, and secretion, proceed with but little derangement. The circulation and respiration are indeed slower than before, and the appetite is in general less keen and returns less frequently; but the digestive powers of the gastric fluids remain in full vigour, and even after death has taken place, are exerted on the coats of the stomach; absorption is also very active, and nutrition, at least in many parts of the body, is sufficiently evident. At length, however, all these functions lose their powers; digestion languishes; the secretions no longer take place; the circulation especially in the minute vessels, becomes obscure, and being deprived of the tonic powers by which it was carried on, gradually ceases altogether; the heart no longer propels the blood from its ventricles; and the circulation through the lungs being thus arrested, these organs cease to take in air, make their last expiration, and thus the natural life of man is terminated †.

368 Accidental or violent death.

Accidental death takes place in one of the two following ways; either suddenly, in consequence of some great disturbance produced in the animal economy, as when a man is cut off by a sudden stroke of apoplexy, violent hæmorrhage, *asphyxia*, &c. or by slow and gradual steps, in consequence of some less violent but still fatal disease. In the former case, it is *sudden* or *violent* death; in the latter *lingering* death.

Violent death may take place first, either in the *brain*, the *lungs*, or the *heart*; but when the action of one of these organs ceases, that of the others soon terminates. The entire cessation of life seems, however, to be more sudden in the two latter cases, and most of all in the last; when the *heart* is wounded or ruptured, the animal dies instantly; when the lungs are rendered inactive in consequence of suffocation, the animal may live for several minutes, or for an hour or two; but when the *brain* is overwhelmed, he may survive for hours or even days. Thus it sometimes happens, in cases of apoplexy, that the patient lies motionless, speechless, and quite insensible to external stimuli, while the circulation and respiration continue, impeded indeed, but not destroyed, for a considerable time, though life, as appears from the event, be in a state of irrecoverable declension. We shall presently show how these circumstances have been explained.

369 Signs of approaching death.

The usual signs of approaching death are, a very quick and small pulse, scarcely distinguishable, and commonly intermitting; coldness, and generally clammy sweats about the extremities; a "lack lustre" eye, sunk in features, want of expression about the countenance, and a prominence of the bones of the face, with a corresponding hollowness in the cheeks, orbits, and especially at the temples. These last appearances constitute the marks of what has been called *facies Hippocratica*. They are all signs of a loss of activity and power in the circulating and nervous systems. Under these bodily circumstances, the powers of the mind seem to decline, generally with an equal pace with those of the body; and when the medium through which the activity of the soul is manifested can no longer act, we cannot expect to find any further traces even of its existence. Yet at the period of its separation, we are told of brilliant mental exertions of powers of intellect, not equalled in the best portion of existence. It has not been our fortune to see such intellectual animation. At the moment of death, anxiety for those we have loved will sometimes occasion apparently disproportioned exertions; and as they were unexpected, they have been exaggerated. But in no instance could we ever detect the activity of mind independent of the body. To this temporary prison the soul is confined, till, by the destruction of the machine, its animating principle is emancipated, soaring probably in higher, and, we trust, in more blissful, regions *.

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* Edin. Med. and Surg. Jour. vol. i p. 308.

† See Bichat Recherches Physiol. part i. art. 10.

370
Signs or criterion of actual death.

A few cases have occurred, in which persons, who were thought dead, have recovered from what was really a state of *suspended animation;* and there is reason to believe, that some unhappy beings have been buried while in this seemingly lifeless state. It becomes, therefore, a matter of the highest importance to ascertain, with certainty, whether or not death has actually taken place. The ordinary signs of death, as enumerated by one of the latest writers on this subject, are as follows:

1. The *suspension of respiration*. 2. The *rigidity* of the limbs. 3. The *loss of sensation* and *motion*. 4. The *want of pulsation* in the heart and arteries. 5. The *spontaneous discharge of feces*. 6. The *collapse, opacity*, and *want of lustre* in the *eyes*. 7. The *coldness* of the body. 8. The *paleness* or *lividity* of the countenance. 9. The *relaxation* of the lower *jaw*. 10. The *regurgitation of liquids* to the mouth. 11. The *insensibility* of the *pituitary membrane* of the *nose*. 12. The *collapse, softness*, and *wrinkling* of the *lips*. 13. The *hollowness* of the *temples*, and *thinness* and *contraction* of the *nose*. 14. *Putrefaction* ‡.

Most of these signs singly have been shown to be fallacious; and none of them, except the last, are to be depended on with implicit confidence. Dr Davis recommends the following mode of procedure. "As soon as the evident signs of life cease, let us place the body in a warm or dry bed, give a proper temperature to the air of the apartment, and employ every means for restoring it to life. If we judge, from the nature of the disease which preceded the death, that these means are useless, we may content ourselves with keeping the body, until its decomposition become manifest; but let us never abandon an unfortunate person, who, perhaps by perseverance in the proper means, may be restored to life: should he recover, he will be a living monument of unexpected resurrection, and of the unceasing efforts of humanity. If a person die of malignant fever, scurvy, internal inflammation, or any other disease which corrupts the fluids, soon after death the belly becomes black and swelled; black or livid spots appear on the limbs and back, the eyes become hollow and soft, and discharge a puriform fluid; the eyelids grow yellow; the mouth opens, because the lower jaw is relaxed; the skin gets soft, the muscles flaccid; and, lastly, the whole body exhales a putrid odour. All these phenomena united, constitute an infallible proof of real death * (N)."

The changes which the animal body undergoes in consequence of death, and during putrefaction, have been amply detailed and explained under CHEMISTRY, chap. xix. sect. 2.

371
Comparative pertinacity of life.

In treating of the general phenomena of life in the first chapter of this article, we made a few observations on the degree of vitality that appears in various tribes of organized beings. There is scarcely a more curious part of the physiology of death than the consideration of the greater or less difficulty with which it is produced in different animals. Some, as the herring and the whiting, die almost instantly on being removed from the situation in which they usually live. Some are killed by a slight blow on the nose or the neck; this is the case with the seal, the rat, the hare, and the rabbit. Others again retain life with great pertinacity. Among the mammalia, the cat is proverbial for being difficult to kill; the sloth has been known to live for above 40 days clinging to a pole, and entirely without food; and Dr Sparrman assures us, that the ratel, or honey weazel (*viverra mellivora*), is so hardy that it is almost impossible to kill it; the colonists and Hottentots both assert, says he, that it is almost impossible to kill this creature, without giving it a great number of violent blows on the nose; and it is remarkable that such a number of hounds as are able collectively to tear in pieces a lion of moderate size, are sometimes obliged to leave the ratel only apparently dead †. Some fishes live for a long time after being removed from the water, and even after being gutted and cut in pieces, as the *carp*, the *flounder* and the *eel*. It is among the reptiles, mollusca, and zoophytes, however, that we find the most remarkable instances of pertinacity of life. Referring the reader to the article ERPETOLOGY for these instances in reptiles, and to HELMINTHOLOGY for those in zoophytes, we shall here only mention two among mollusca. The sea marigold (*actinia calendula*) is destroyed with such difficulty, that after drilling the holes of the rock from which they appear, with an iron instrument, they have been known to rise again in the same places, and become as numerous as before in the course of a few weeks ‡. Snails whose remarkable suspended animation we have already recorded, may be crushed beneath the foot, and will yet survive, and repair the breaches in their shelly covering; nay, they are capable of passing the ordeal of boiling water, as we learn from the relation of a lady who, wanting some snail shells for a piece of grotto work, attempted to kill the animals by repeatedly pouring over them boiling water; but to her horror and astonishment, she observed them next day crawling about the edges of the vessel in

* New Lond. Med. Dict. vol. i. p. 534.

‡ Davis Reglement concernant les décès, part ii.

* Ibid.

† Sparrman's Voyage.

‡ Hughes's Nat. Hist. of Barbadoes.

(N) The work of M. Bruhier, *sur l'Incertitude des Signes de la Mort*, from which these remarks of Dr Davis appear chiefly to be taken, created so much alarm in France, that every body dreaded being buried alive. To combat these terrors, M. Louis, in 1752, published his *Lettres sur la Certitude des Signes de la Mort*; in which he has very happily, and we think successfully, refuted the arguments of Bruhier, and has thereby relieved the minds of his readers from one of the most dreadful apprehensions that can appal us on this side the grave.

in which she had scalded them*. It is in vain for us to attempt any explanation of these extraordinary phenomena. We must refer them to some principle in the animal economy which is at present unknown.

372 **Causes of death.** The remote causes of death have been, by Dr Ontyd, arranged under 12 general heads, to which he gives the name of *classes*. These we shall enumerate, with their principal subdivisions.

I. Death arising from the mechanism of the body.

II. Death from the passions of the mind.

1. *Exciting passions*; 2. *Depressing passions.*

III. Death from superabundance or deficiency of heat.

1. *From superabundant heat*; 2. *From deficient heat.*

IV. Death from electricity.

V. Death from noxious gases.

1. *From hyperoxygenized gases*; 2. *From deoxygenized gases*; 3. *From peculiarly stimulating gases.*

VI. Death from poisons.

1. *Animal poisons*: 2. *Vegetable Poisons*; 3. *Mineral poisons.*

VII. Death from universal disease.

1. *Fevers*; 2. *Febrile diseases* (exanthemata).

These seven classes are supposed to produce death by the immediate extinction of the *vital principle*; the five following are supposed to effect this by suppressing the action of some vital organ, or by disordering the chain of the vital powers by destroying the action of some of the intermediate links.

VIII. Death from inflammations.

1. *Inflammations of the head*; 2. *Of the breast*; 3. *Of the belly.*

IX. Death from fluxes.

1. *Alvine fluxes*; 2. *Hemorrhages.*

X. Death from cachexies.

1. *Ulcers*; 2. *Atrophies*; 3. *Debilities and Privations.*

XI. Death from diseases of the nervous system.

1. *Atony*; 2. *Spasm.*

XII. Death from diseases of the secretory organs.

1. *From altered action*; 2. *From altered structure*†.

373 **How these operate.** The manner in which these causes operate in terminating life, is thus stated by the same author.

The causes of the *first class* act by inducing too great a rigidity of the solids, and by rendering them insensible to *stimuli*; the necessary effects of the continued action of the powers of *life*. In death from causes of the *second class*, the person dies in consequence of *apoplexy*, *syncope*, or *suffocation*; the brain, the heart, or the lungs, being overwhelmed by accumulated blood. The causes of the *third class* act in a similar manner with those of the second; that of the *fourth* by suddenly extinguishing the *vital principle*; those of the *fifth* always act by inducing *suffocation*. The causes of the *sixth* class act in *four* ways: 1. By abolishing the vital principle by the violence of their stimulus; 2. By destroying the action of the brain, the heart, or the lungs; 3. By producing mortification of the intestinal canal; 4. By secretly and insensibly destroying life. Those of the *seventh* class act in *six* ways: 1. and 2. As in the last; 3. By local inflammation; 4. By *mortification* of some *vital organ*; 5. By a change in the organic structure of the intestinal canal inducing a colliquative *diarrhœa*; 6. By *colliquative sweats* wasting the body.

The causes of the *eighth* class act in *four* ways: 1. By inducing violent convulsions; 2. As in the two last; 3. By suppressing the action of some vital function from the violence of the inflammation; 4. By mortification. The *ninth* class may act in *five* modes: 1. By *spasm*; 2. By fatal *syncope*; 3. By impeded action of some vital organ; 4. By mortification or *sphacelus*; 5. By wasting the strength in *fruitless exertions*. The *tenth* class may act in no less than *nine* ways: 1. By the consumption of some vital organ, or destroying the tone of the whole body; 2. By the violence of the noxious stimulus; 3. By suffocation; 4. By apoplexy; 5. By *syncope*; 6. By hemorrhage; 7. By colliquative *diarrhœa*; 8. By mortification of some organ; 9. By malignant fever from absorbed ichorous matter. The causes of the *eleventh* class act only in two ways: 1. By violent spasm; 2. By apoplexy. Those of the *twelfth* class, produce death in three modes: 1. By the slow effect of the noxious stimulus; 2. By the continually stimulating noxious power alone, or by this and the continual wasting of the blood, to form some peculiar secretion; 3. By impeding or destroying the function of a vital organ*.

Many of these modes of operation are very ill defined, and they may all be reduced to about eight or ten, or perhaps even fewer.

374 **Nature of death.** Death has been defined *the separation of the soul from the body*†; the *extinction of the vital principle*; the *extinction of the faculty of answering a stimulus*‡, &c. &c. Perhaps we cannot describe it better than by calling it *the irrecoverable cessation of all the bodily functions.* By this character we distinguish it from *suspended* animation and *lethargy*, in which *some* of the functions continue; while we acknowledge the survival of the *immaterial part* of our frame.

It has been the general opinion among philosophers, both of ancient and modern times, that death produces only a change of the elements or principles of the organized body; and does not effect the *annihilation* of any part. Modern chemistry has fully confirmed this opinion, and has shown that by putrefaction the body is dissolved into a few *earthy*, *saline*, and *gaseous* products, all capable of entering into new combinations, and thus constituting a part of future bodies. See CHEMISTRY, N° 2572, and MAN, N° 44.

Of all the writers on the nature and phenomena of death, with whom we are acquainted, none has treated the subject with such accuracy and philosophic method, as Bichat. With a summary of some of the leading principles of this able physiologist we shall close the present chapter, and thus terminate our physiological enquiries.

375 **Opinions of Bichat.** We have already mentioned Bichat's division of life into *animal* and *organic*: see N° 49. Proceeding on the principle of this division, he conceives that the two lives terminate in different ways, and that one often terminates while the other remains active. In the natural death that happens from old age, the *animal life* gradually ceases in the order we have described, N° 367, while the *organic* life remains. The same happens in those cases of violent death where life first ceases in the brain, this organ being the centre of animal life. In other cases of violent or accidental death, the *organic* life first ceases in its central organs, the *heart* or the *lungs*; but in these cases, the *animal* life also is speedily suppressed.

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* *Annual Register*, vol. xvii. p. 86.

† *Ontyd on Mortal Diseases.*

* *Ontyd*, p. 637.

† *Johnson.*

‡ *Ontyd.*

	VI. RESPIRATION.	VII. SECRETION.	VIII. REPRODUCTION.
1. ORGANS	Nostrils, *Larynx*, Windpipe, Lungs, and *Diaphragm.*	Salivary glands, Liver, *Pancreas*, Kidneys, *Testes*, Mucous glands, Membranes, &c. Miliary glands, Brain?	*Penis*, Testicles, *Vesiculæ Seminales*, Prostate gland, Spermatic vessels in Man; *Vulva*, *Vagina*, *Uterus*, and the *Mammæ*, in Woman.
2. FLUIDS.	Blood and *Mucus.*	Tears, *Mucus*, *Saliva*, Gastric juice, Pancreatic juice, Bile, Lymph, *Synovia*, Fat, Marrow, *Cerumen*, *Semen*, Urine, Milk, Nervous fluid?	*Semen*, Mucous fluid, Prostatic fluid, *Liquor amnii*, and Milk.
3. PHENOME	Purification of the fluids, Renewal of action, Animal heat, Mutual action between the air and the animal solids and fluids.	Separation of fluids useful in the economy, and Expulsion of noxious or useless parts.	Copulation, Conception, Parturition, Lactation.
4. POWER	As in CIRCULATION.	Various.	Generative power.
5. RELATIVE P MINANCE	Much as in CIRCULATION.	In middle age; various as to sex and temperament; in *warm* climates.	In *youth;* in those of a sanguine temperament, and lively imagination.
6. PRINCIPAL M AFFECTION	Yawning, Sighing, Sobbing, Hiccup, Sneezing, Coughing, Anxiety, *Dyspnœa*, *Stertor*, *Asphyxia*, Dumbness.	Increased secretion, Diminished secretion, Depraved secretion, Jaundice, *Calculus*, &c.	*Priapismus*, *Satyriasis*, *Nymphomania*, *Menorrhagia*, *Amenorrhœa*, Impotence, Sterility.

It is to violent or accidental death that Bichat principally confines his discussions, and in order to determine with precision the phenomena that take place in the three species, he examines at great length the relations that subsist among the three functions of circulation, respiration and sensation, as they are affected by the death of the *heart*, the *lungs*, or the *brain*. He first considers those cases of sudden death that commence with the death of the heart; then those originating in the lungs; and lastly those originating in the brain. He shows how, one of these functions ceasing, the others successively stop; he points out the mechanism, by which the death of all the parts follows that of the organ first affected; and he determines, according to his own principles, the nature of the several diseases by which the life of the heart, the lungs, or the brain, is extinguished *.

We consider this as the most interesting part of his valuable work, and it well deserves the attentive perusal of every medical man. We regret that we cannot do more than extract from it the view given by the author of the successive phenomena produced by the influence which the death of each of the vital organs exerts on the general death of the body.

376
Progress of death commencing in the heart.

Whenever the heart ceases to act, says Bichat, general death comes on in the following manner. The action of the brain ceases for want of excitation; and from the same defect, the sensation, locomotion and speech, which immediately depend on the general sensorium, are interrupted. Besides, for want of the excitation of part of the blood, the organs of these functions would cease to act, even though the brain were supposed capable of exerting on them its usual influence. The whole of the animal life, then, is suddenly arrested. The man, from the moment that his heart dies, ceases to exist with respect to surrounding objects.

The interruption of *organic* life, which has commenced through the circulation, operates at the same time through the respiration. The mechanical actions of the lungs no longer proceed when the brain ceases to act, since on this organ depends the action of the diaphragm and intercostal muscles. The chemical changes can no longer take place, when the heart can neither receive nor convey the materials necessary for their developement. In short, general death continues to proceed in a gradual manner, by the interruption of *secretion*, *exhalation*, and *nutrition*. These are the effects produced when death is the consequence of a wound of the heart or large bloodvessels, a rupture of the heart, or similar accidents †.

377
Progress of death commencing in the lungs.

The series of phenomena that take place in death, as commencing in the lungs, is different according as the *mechanical* or the chemical action of these organs is first arrested. I. In the former case, as when death is produced by an extensive wound or laceration of the diaphragm, by the fracture of a great many ribs at the same time, &c. they proceed as follows: 1. Cessation of the mechanical action; 2. Cessation of the chemical phenomena, for want of the air which supported them; 3. Cessation of the brain's action for want of the red blood by which it was excited; 4. Interruption of animal life, of sensation, locomotion, and speech, from the loss of the exciting powers of the brain and the red blood on the organs of those functions; 5. Stoppage of the *general* circulation; 6. Stoppage of the circulation in the capillaries, of secretion, absorption, exhalation, for want of the excitation exerted on their organs by the red blood; 7. Cessation of digestion, for want of secretion, and of excitation of the digestive organs. II. When the chemical action of the lungs is interrupted, as when an animal is confined in a *vacuum;* in cases of *strangulation*, *suffocation*, *drowning*, &c. the phenomena of death proceed in the following order: 1. Interruption of the chemical phenomena; 2. Consequent suspension of action in the brain; 3. Cessation of sensation, voluntary motion, voice, and the mechanical functions of respiration; 4. Stoppage of the heart's action; and of the general circulation: 5. Termination of the capillary circulation, of secretion, exhalation, and absorption, and, by consequence, of digestion; 6. Cessation of animal heat, which, being the result of all the functions, must cease when all these are terminated ‡.

378
Progress of death commencing in the brain.

The phenomena of general death commencing in the brain come on in the following series: 1. Cessation of the brain's action; 2. Sudden interruption of sensation and voluntary motion; 3. Simultaneous paralysis of the diaphragm, and intercostal muscles; 4. Interruption of the mechanical phenomena of respiration, and, by consequence of voice; 5. Cessation of the chemical phenomena; 6. Passage of the *black* blood into the system of *red* blood; 7. Impeded circulation, from the action of the black blood on the heart and arteries, and from the immobility of all the parts, especially the organs of the chest; 8. Death of the heart, and stoppage of the general circulation; 9. Simultaneous interruption of organic life, especially in the parts that are usually penetrated by red blood; 10. Abolition of animal heat §.

379
Conclusion.

We have now gone through the series of physiological enquiries, into which we proposed to enter in this article. In forming an estimate of the merit due to our labours, we request that our readers will consider the article in a great measure supplemental to many that have preceded it in the course of the present work. It has been our principal object to fill up blanks and supply deficiencies, especially with respect to *Comparative Physiology;* and to form, with those preceding articles which have a reference to the *animal economy*, particularly ANATOMY, MEDICINE, MIDWIFERY, CHEMISTRY, MAN, one *connected*, if not *uniform* whole. The difficulty of the task we had undertaken will probably be admitted as some apology for the imperfect execution of it; while the variety and interesting nature of the subjects which we have treated, with the numerous references to the most respectable sources of information, will, we trust, render this article acceptable both to the general and the scientific reader. See ANATOMY, ANIMAL, COMPARATIVE and VEGETABLE, SUPPLEMENT.

EXPLANATION

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* *Recherches*, part ii. art. i

† *Id.* art. 5.

‡ *Id.* art. 9.

§ *Id.* art. 13.

EXPLANATION OF PLATE CCCCXVIII.

Fig. 1. *Exhibits a view of the exit from the head, and distribution in the chest, of the great sympathetic nerve, intended to illustrate the mutual relations between the head and the principal organs of the chest aud belly.*

A. The right *parotid gland* laid bare.

B. The *submaxillary gland.*

C, D, E. The *digastric muscle*, partly covered by the *submaxillary gland.*

F. Part of the *thyroid gland.*

G, G. The *œsophagus* or gullet.

H, H. The windpipe or *trachea.*

II. III. IV. V. VI. VII. The bodies of the six lower *vertebræ* of the neck; VIII. IX. the two first vertebræ of the back.

I, K, L. The heart, with part of the pericardium attached.

p, p. The arch of the aorta, drawn aside.

q. The common trunk of the right subclavian (*s*) and right carotid (*r*) arteries.

P. The *vena cava* from the *superior* parts; Q. That from below.

R, S, T. The right lobe of the lungs.

U, V. Part of the left lobe.

W, X, Z. Muscular parts of the *diaphragm.*

a. The first cervical or great *ganglion*, from which proceed, *b.* The trunk of the great sympathetic nerve, and *c.* The eighth pair of neves, or *par vagum.*

d. The lower cervical *ganglion*, opposite the fifth cervical *vertebra.*

e. The upper thoracic *ganglion*, opposite the first vertebra of the back.

f. The third dorsal *ganglion*, between the second and third rib.

g. The *accessory nerve* of Willis.

h, i, k, l. Trunks of some of the cervical nerves.

m. The *cardiac plexus* formed by branches from the sympathetic nerve.

n, n. The *par vagum* running down to the *diaphragm*, through which it passes, unites with the *intercostal*, forms various *ganglia*, and gives branches to most of the abdominal *viscera.*

o, o. The *phrenic* nerves distributed to the *diaphragm.*

Fig. 2. A section of the cuticle of the *lilium chalcedonicum*, to shew the *lymphatic vessels*, much magnified.

Fig. 3. A similar magnified view in the *onion.*

Fig. 4. Ditto in the *pink.*

Fig. 5. Represents the atlantal extremity of the slow lemur (*lemur tardigradus*), to show the curious division of the *subclavian* artery.

a. The subclavian artery, lying upon the *subscapularis* muscle.

b. The division of the artery into equal-sized cylinders.

c. The ulnar artery proceeding to divide in the usual manner

Fig. 6. Represents the sacral extremities of the same animal, showing a similar division of the inguinal artery.

a. The *diaphragm.*

b. The descending *aorta.*

c, c. The iliac *arteries.*

d. The trunk of the *inguinal* artery, situated among the cylinders.

e. The femoral artery under similar circumstances.

The annexed Table sufficiently explains itself.

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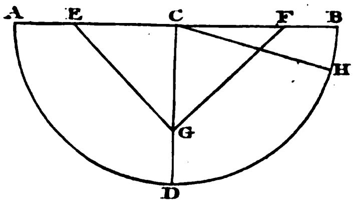
Fig. 1.



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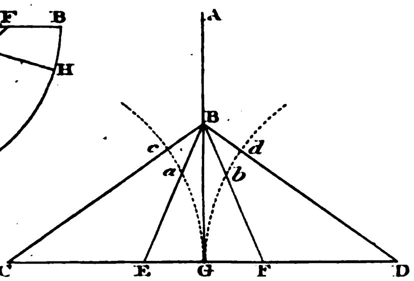

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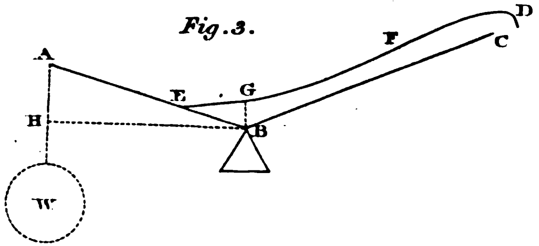

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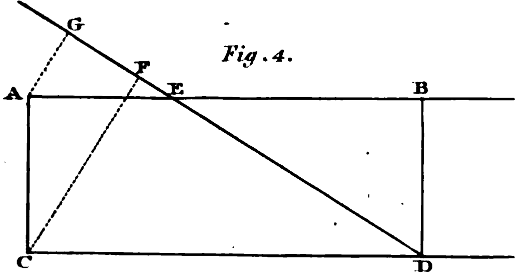

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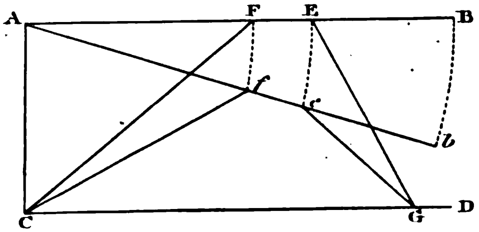

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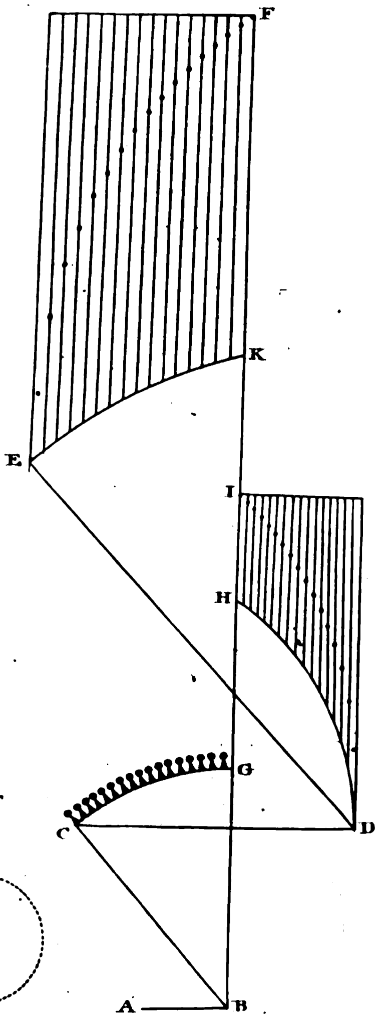

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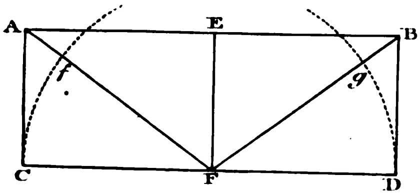

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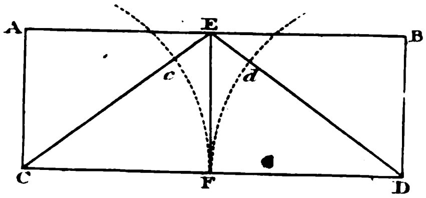

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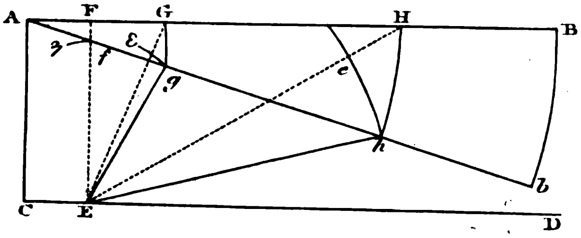

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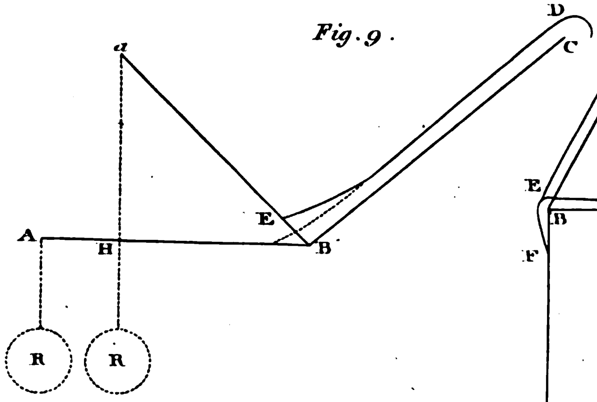

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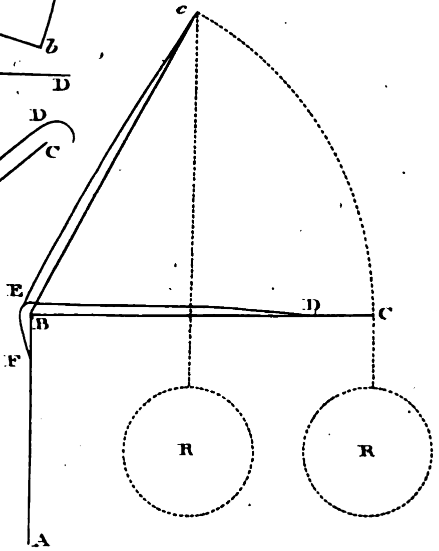
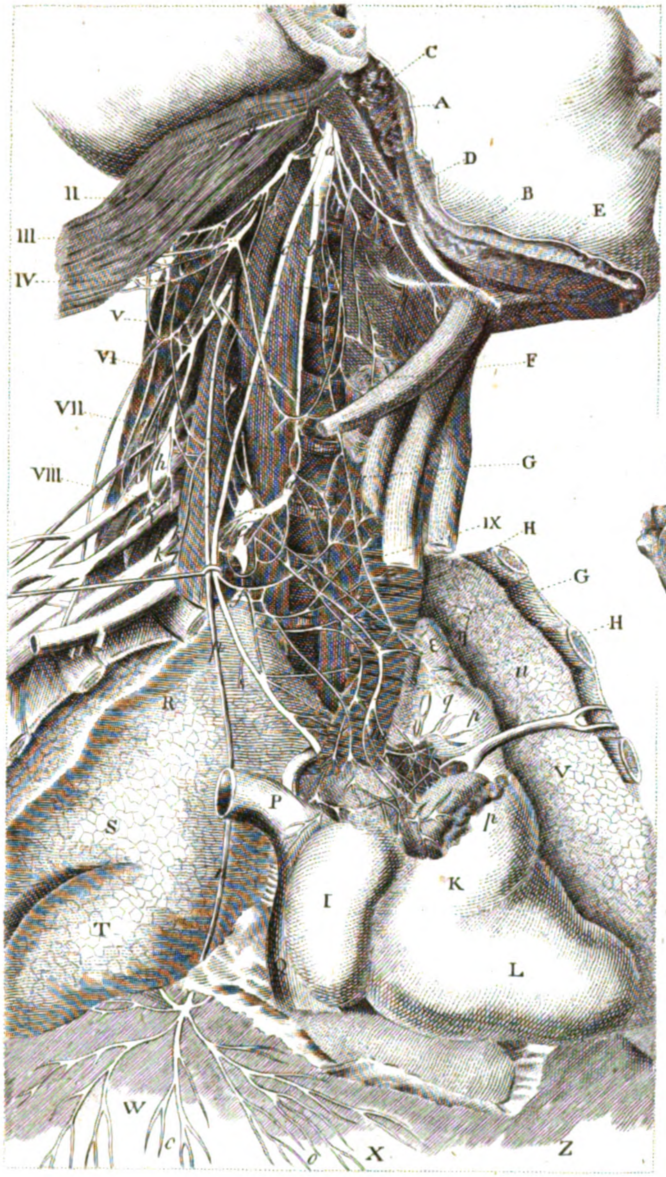


W. Archibald Sculpt.

PHYSIOLOGY. PLATE CCCCXVIII.

Fig. 1.



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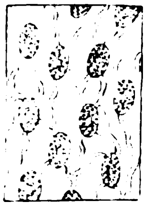

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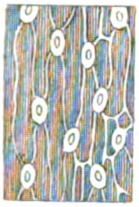

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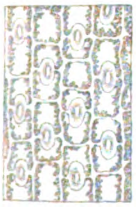

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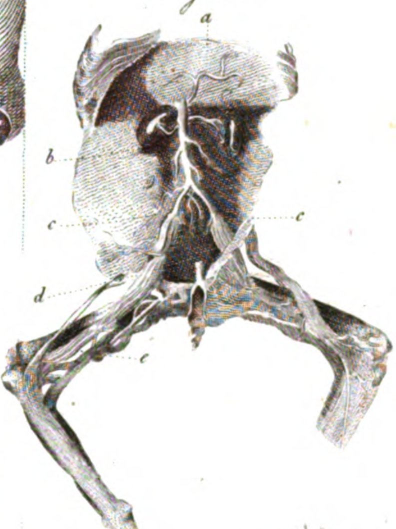

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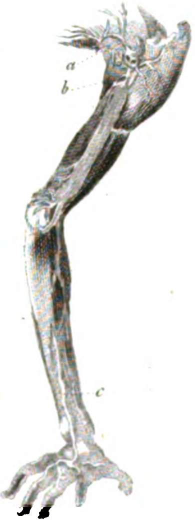
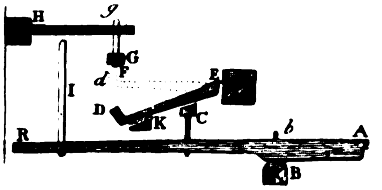


PIANO FORTE KEY



W. Archibald sculp.

PHYTOLACCA, POKEWEED, or *American Nightshade*, a genus of plant belonging to the decandria class. See BOTANY *Index*.

PHYTOLOGY, a discourse concerning the growth, kind, and virtues of plants. See BOTANY, and MATERIA MEDICA.

PHYTON, a general of the people of Rhegium against Dionysius, the tyrant of Sicily. He was taken by the enemy, and tortured, and his son was thrown into the sea. See SYRACUSE.

PIA MATER, a thin membrane which covers the brain, and is in immediate contact with it. See ANATOMY *Index*.

PIABA, in *Ichthyology*, is a small fresh water fish caught in all the rivers and brooks in the Brasils, and in some other parts in America. It is about the size of the common minow.

PIABUCU, in *Ichthyology*, is an American fish, eaten in many places by the natives. It is said to be so ravenous, and greedy of blood, that if a person go into the water with a wound in any part of his body, the piabucu will make up to it to suck the blood. It seldom exceeds four inches in length.

PIACENZA is a city of Italy, in the duchy of Parma, in E. Long. 10. 25. N. Lat. 45. It is a large handsome city, whose name is derived by some from its pleasant situation, in a fruitful plain, on the Via Æmilia, about half a mile from the Po. It is the see of a bishop suffragan of Bologna, and has a university, but of no great fame. It is defended by a wall and a strong citadel, and is reckoned about three miles in circumference, so that it is somewhat bigger than Parma. The houses are low, but well built; the great street, called the *Stradone*, is in a direct line and of equal breadth, with a foot-way fenced with posts on each side like London, and is about 3000 feet long. The houses are generally built of brick, and some of them are prettily painted. The cathedral is an old structure, but well adorned within. The duke of Parma, who is sovereign of Piacenza, has a palace in the city built by Vignola. There are many excellent paintings in this place. There are two chapels painted, one with the history of St Catharine, and the other with a picture of Christ, as also the altar of the church of St Augustine, all by Pordenone. In the same church there is a fine picture of the blessed virgin, St Peter, and St Paul, by Paolo Veronese. At the Capuchins there is a Francis by Guercino. There is a fountain said to have been erected here by Julius Cæsar, and the equestrian statues of the famous general Alexander I. duke of Parma and Placentia, and of his son Ranuccio, both in the great square. In the palace of Scotti, there are a great many fine pictures by Lanfranco, who had been a page in their family, and among the rest the rape of Helen, the taking of Troy, the blessed virgin, and St Francis. The trade of this city consists chiefly in their cheese, as at Parma, these cities being surrounded with the richest pasture grounds in Italy; though the greatest part of what is called Parmesan cheese is made in the duchy of Milan, and particularly at Lodi. See *Parmesan CHEESE*.—Without the walls, which are washed by the rivers Trebbia and Po, there is a large seminary or college, magnificently erected by Cardinal Alberoni, a native of this city, but considerably hurt by the modern Goths in the last war. Towards the north of the city is the mouth of the river Trebbia, famous for the victory which Hannibal obtained over the Romans.

PIANO FORTE, or FORTE PIANO, is a musical instrument, which is too well known to require any detailed description. We shall here, however, notice some of its peculiarities. The voice, it has been observed, is the original musical instrument; of this all other instruments are to be considered but as imitations; and it is remarkable with what promptitude, as well as accuracy, the voice of man obeys the impulse of the heart. Even a coarse ear is hurt by an error in its tone, amounting to what is called a *comma;* and a limited voice can execute melodies which include 12 notes, or an octave and a fifth. Between these extremes the motion of the glottis does not amount to one twelfth of an inch, which must therefore be divided by the most ordinary singer into more than 1000 parts. All this too, without any seeming effort of thought, is done in an instant, and repeated with rapidity, without mistaking one of the divisions.

The great object in the construction of musical instruments is, to bring them as near as possible to express the sounds produced by the human voice: the violin, however, and a few of the simple wind instruments, are the only ones found fully to express these momentary gradations of sentiment, and those tender and delicate emotions with which the heart is agitated. For the purpose of removing this defect of harmonic instruments, the swell was added to the organ. Similar improvements were also attempted on other instruments of the same kind, and the same way. The harpsichord was shut up like the swell organ, and was opened by means of pedals, when the performer wished to enforce the sound. But as this was found not to succeed well, other methods were tried, and in particular unisons were added to each note, which were brought on, either by means of pedals, or by another set of keys; and in this way the power of the harpsichord was greatly improved. Among all the keyed instruments, the English piano forte seems to merit the preference, on account of the superior force of tone, adequate sweetness, and great variety of voice, of which, by the ingenuity of British artists, it has now become susceptible. It has been called a national instrument, because it is said to be an English contrivance, the invention of the celebrated poet, Mason. Mr Mason had seen some attempts that were made by the Germans to make keyed dulcimers, which were in some measure susceptible of the *forte* and *piano;* but as they were all constructed on one principle, and required a particular touch of the finger, which was of difficult acquisition, and which spoiled it for harpsichord practice; as they were also deficient in delicacy and justness; and as the performer was by no means certain of producing the very strength of sound intended, Mr Mason removed all those imperfections, by detaching the mallet entirely from the key, and giving them only a momentary connection. It is by this improvement that the English piano forte is distinguished from all others. Mr Mason's general principle may be fully understood by the following description. In the figure on Plate CCCCXVIII. the parts are represented in their state of inaction. The key ABK turns, as usual, on the round edge of the bar B, and a pin *b*, driven into the bar, keeps it in its place.

The dot F represents a section of the string. ED is the mallet, having a hinge of vellum, by which it is attached to the upper surface of the bar E. At the other end is the head D, of wood, covered with some folds of prepared leather. The mallet lies in the position represented in the figure, its lower end resting on a cushion-bar K, which lies horizontally under the whole row of mallets. The key AR has a pin C, tipt with a bit of the softest cork or buckskin. This reaches to within $\frac{1}{20}$th of an inch of the shank of the mallet, but must not touch it. The distance E *e* is about $\frac{1}{3}$d or $\frac{1}{4}$th of the length of the shank. When the end A of the key is pressed down on the stuffing (two or three thicknesses of the most elastic woollen list) it raises the mallet, by means of the pin C, to the horizontal position E *d*, within $\frac{1}{8}$th or $\frac{1}{10}$th of an inch of the wire F; but it cannot be so much pressed down as to make the mallet touch the wire. At the same time that the key raises the mallet by means of the pin C, it also lifts off the damper G (a bit of spunge) from the wire. This damper is fixed on the end of a little wooden pin G *g*, connected with the lever *g* H, which has a vellum hinge at H. This motion of the damper is caused by the pin I, which is fixed into the key near to R. These pieces are so adjusted, that the first touch of the key lifts the damper, and, immediately after, the pin C acts on the shank of the mallet. As it acts so near to its centre of motion, it causes the head D to move briskly through a considerable arch D *d*. Being made extremely moveable, and very light, it is thus *tossed* beyond the horizontal position E *d*, and it strikes the wire F, which is now at liberty to vibrate up and down, by the previous removal of the damper G. Having made its stroke, the mallet falls down again, and rests on the soft substance on the pin C. It is of essential importance that this mallet be extremely light. Were it heavy, it would have so much force, after rebounding from the wire, that it would rebound from the pin C, and again strike the wire. For it will be recollected, that the key is, at this time, down, and the pin C raised as high as possible, so that there is very little room for this rebound. Lessening the momentum of the mallet by making it very light, making the cushion at the top of the pin C very soft, and great precision in the shape and figure of all the parts, are the only securities against the disagreeable rattling which these rebounds would occasion. In respect to the solidity and precision of workmanship, the British instruments are unrivalled, and vast numbers of them have been sent to all parts of the continent.

As the blow of so light a mallet cannot bring much sound from a wire, it has always been found necessary to have two strings for each note. Another circumstance contributes to enfeeble the sound. The mechanism necessary for producing it makes it almost impossible to give any considerable extent to the belly or sound board of the instrument. There is seldom any more of it than what occupies the space between the tuning pins and the bridge. This is the more to be regretted, because the basses are commonly covered strings, that they may be of a moderate length. The bass notes are also of brass, which has a considerably lower tone than a steel wire of the same diameter and tension. Yet even this substitution for steel in the brass strings is not enough. The highest of them are much too slack, and the lowest ones must be loaded, to compensate for want of length. This greatly diminishes the fulness, and still more the mellowness and distinctness of the tone, and frequently makes the very lowest notes hardly appreciable. This inequality of tone about the middle of the instrument is somewhat diminished by constructing the instrument with two bridges; one for the steel, and the other for the brass wires. But still the bass notes are very much inferior to the treble.

PIASTUS, a native of Poland, was originally a wheelwright, and the son of Cossisco, a citizen of Cruswitz. He flourished in the year 830, when on the extinction of the family of Popiel great disputes arose about his successor, and Cracow was afflicted with a severe famine. During this extremity, when the people were dropping down in the streets, two angels in human forms, as the story is told, took up their residence with Piastus, who was celebrated for his piety and extensive charity. He had nothing left but a small cask of the common liquor of the country, and this he presented to his new guests, who, charmed with his hospitality, promised him the crown of Poland. The faith of Piastus was equal to his other virtues: he implicitly believed the word of his guests, and piously followed their directions in every particular. He was ordered to distribute the liquor out of his little cask to the multitude: he did so, and found that it was inexhaustible. The people were astonished; all cried out, "A miracle!" and the electors determined to choose a person in whose favour Heaven had so visibly declared: Piastus was accordingly taken from his shop, and raised to the ducal dignity.

Mod. Univ. History, vol. xxx. p. 336, &c.

Such is the relation of the canon of Cracow, which differs in many particulars from the account given by Guagnini, and several other historians. According to them, Piastus had prepared a small collation, to entertain some friends who were assembled at the birth of a child. Two pilgrims, Paul and John, afterwards murdered at Rome, came about this time to Cracow. They begged charity at the door of the election-hall, and were rudely repulsed; upon which they stumbled on the house of Piastus, and were kindly received. The miracle we have mentioned was wrought by them; and the two pilgrims, and not angels, were the instruments of the elevation of the hospitable wheelwright. Though we pay but little regard to the marvellous means by which Piastus ascended the ducal throne of Poland, it would be presumptuous entirely to omit a fact attested by all the writers upon this subject: it was proper, therefore, to take notice of it, and we leave the rest to the reader's judgment,

Being now raised to the supreme dignity, he was not intoxicated with his prosperity. His natural charity, benevolence, and sweetness of disposition, remained: nothing was altered but his power of doing good. He was truly called the father of his people: the injured never returned unredressed, nor merit unrewarded. Piastus wiped the tear from the eyes of the widow; and was himself the guardian of the orphan, and the general patron of the poor and distressed. His excellent inclinations served him in the room of great abilities; and the happiness that his people enjoyed made them forget that their prince was not born a statesman and a warrior. Several intestine commotions arose during his administration, all which he quelled by the mildness and clemency of his nature: his nobility were ashamed of rebelling against a sovereign who devoted his whole life to render his people happy. He removed the court from Cruswitz, a city which he detested, because it was the scene of Popiel's crimes and tragical end, and fixed his residence at Gnesna, where he died beloved, esteemed, and even adored by his subjects.

It is in memory of this excellent prince, that all the natives of Poland, who have been since promoted to the ducal or regal dignity, were called Piastes, in contradistinction to the foreigners.

Piastus associated his son Ziemovitus with him in the government before his death; a circumstance of much benefit to the people.

PIAZZA, in building, popularly called *piache*, an Italian name for a portico, or covered walk, supported by arches.

The word literally signifies a broad open place or square; whence it also became applied to the walks or porticoes around them.

PIBROCH, says Dr Beattie *, is a species of tune peculiar, I think, to the Highlands and Western isles of Scotland. It is performed on a bagpipe, and differs totally from all other music. Its rythm is so irregular, and its notes, especially in the quick movement, so mixed and huddled together, that a stranger finds it almost impossible to reconcile his ear to it, so as to perceive its modulation. Some of these pibrochs, being intended to represent a battle, begin with a grave motion resembling a march, then gradually quicken into the onset; run off with noisy confusion and turbulent rapidity, to imitate the conflict and pursuit; then swell into a few flourishes of triumphant joy; and perhaps close with the wild and slow wailings of a funeral procession.

PICA. See CORVUS, ORNITHOLOGY *Index*.

PICA Marina. See HÆMATOPUS, and ALCA, ORNITHOLOGY *Index*.

PICA, in *Medicine*, a depravation of appetite, which makes the patient long for what is unfit for food, or incapable of nourishing; as chalk, ashes, coals, plaster-lime, &c. See MEDICINE *Index*.

PICA, or *Pye*, had formerly the same sense as *ordinal*, meaning a table or directory, pointing out the order in which the devotional services appointed for different occasions were to be performed. Accordingly we are told it is derived from πι, a contraction of πιναξ, *a table*; and by others from *litera picata*, a great black letter at the beginning of some new order in the prayer. The term was used in a similar sense by officers of civil courts, who called their kalendars or alphabetical catalogues directing to the names and things contained in the rolls and records of their courts the *pyes*.

PICA, or *Picus*, *John*, prince of Mirandola and Concordia, was born in the year 1463, under the pontificate of Pius II. He was the youngest son of John Francis of Mirandola, and Julia, a lady of the noble family of Boiard. Some of the credulous historians of the time have related, that at his birth a globe of fire was seen to rest upon his mother's bed, portending, say they, by its shape the perfection of his genius, and by its element, the celestial turn of his mind. As soon as he was capable of receiving instruction, he was placed by his mother's care under the most able masters, and very early distinguished himself by the vigour of his application, and the strength of his memory; of which such prodigies are related as would be very difficult to credit, were we not assured by some modern instances, of the perfection to which that faculty may be carried. At the age of fourteen he was sent by his mother's direction, who was desirous that he should assume the clerical functions, to Bologna, at that time the principal resort of those who studied the pontifical law. After spending two years there, he became disgusted with this pursuit, although such was his industry, even at that early age, that he compiled an epitome of the pontifical epistles or decretals. His disposition, however, strongly led him to the pursuit of philosophy, with an eager curiosity to penetrate the secrets of nature and science: with this view he travelled over Italy and France, visited the most celebrated schools of each, and studied under the most famous teachers of both countries. After seven years spent in this course of instruction, and at the age of twenty-three, he went to Rome, and, after the fashion of the scholars of that time, brought himself into notice by publicly proposing literary questions for disputation. This sort of challenge was very common in that age, and, when printing was scarcely practised, and the name of a man of learning less rapidly extended than it is now, was almost the only method that a person of superior attainments had to make himself known. Mirandola proposed 900 questions, or as they were called *conclusiones*, in dialectics, mathematics, natural philosophy, and divinity, drawn not only from the stores of the Latin and Greek, but from the mysteries of the Hebrews and the arcana of the Chaldeans and Arabians. In addition to the endless topics of metaphysics, theology, and the ordinary subjects of disputation, into which he entered very profoundly, the *conclusiones* involved the ancient and obscure philosophy of Pythagoras, Trismegistus, and Orpheus; the doctrines of the Cabala, or mystic interpretation of the sacred writings, according to the Hebrews, taught by Origen and Hilarius; the extent, uses, and learning of natural magic, which was vindicated from the vulgar reproach of impiety and necromancy. Seventy-two new physical and metaphysical dogmata of the author's invention were likewise proposed and defended. These propositions, according to the ostentatious practice on these occasions, were fixed in the most public places in Rome, and the proposer engaged to defray the expences of any one who should come from a distance for the purpose of disputing with him. This challenge did not bring forward any disputants, but exposed Mirandola to much envy and jealousy, particularly from the professors of science at Rome, who felt the reflection that would be cast upon their credit by their declining a competition which they durst not encounter. Unable to injure his fame as a scholar, they made a much more dangerous attack upon the soundness of his faith; thirteen questions were selected, which were charged with the terrible suspicion of heresy and contempt of the ordinances of the church; a suspicion very readily listened to by the church when directed against great learning, which the increasing influence of philosophy and letters began to make her watch with extreme jealousy. Mirandola repelled this attack by publishing his Apologia, or Defence of the accused Propositions; which if he did not effectually clear away the suspicions he had incurred, tended to confirm his enemies in their dread of his learning and powers; and it must be owned that, overlooking the misapplication of talents to such subjects, the Apologia exhibits a command of profound and well digested learning and keen argument, truly astonishing at the age of twenty-three. This work, and the discussions it contained of certain delicate points, added to some hints of the limit of pontifical controul in matters of faith, were so disagreeable to Pope Innocent VIII. that he interdicted the reading both of the Apology and the disputed questions. The love of glory, however, was not Mirandola's only passion: his youth, splendid accomplishments, and the graces of his person, for which he is said to have been remarkable, attracted the admiration and caresses of many distinguished Roman ladies, who united the love of letters to that of pleasure, a taste very common amongst the Italian ladies of that age. The young philosopher yielded to the force of these allurements, or rather, according to the account of his nephew and biographer, Francisco of Mirandola, eagerly followed the bent of his disposition, naturally inclined to obey the attractions of beauty.

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* *Ess. by Dr Beattie*, 8vo edit. p. 422. note.

But this life of pleasure, however suitable to his condition and inclinations, was of a short continuance. Irritated by the restless persecutions of his enemies, and obliged perpetually to defend himself against the imputation of heresy, the most formidable calumny which in that age any man could have to contend with, he detached himself from vicious pleasures, and regulated his manner of life by rigidly observing the laws of abstinence imposed by Christianity; for being a firm adherent to the Christian doctrines, the charge of infidelity and the vigilance of his enemies made him the more solicitous to guard against the appearance of disobeying them. Becoming from this time wholly devoted to learning, he soon acquired such celebrity that the most eminent scholars from all parts of Italy came to visit him for conversation or instruction. As a proof of the sincerity of his reformation, he committed to the flames five books of elegiac poetry which he had composed on the subject of his amours, together with numerous pieces in Tuscan verse, which had been addressed to his various mistresses. There is perhaps reason to lament that the zeal of a new convert would not be satisfied without this sacrifice. It must, however, be considered that the spirit of religion at that period exacted many sacrifices from the professors of Christianity, which the lenient temper of these times does not call for. An example of this severity is to be met with amongst the works that still remain of Mirandola; at the end of which, in the folio edition published by his nephew, we find a learned and entertaining comment, in the Italian language, upon a composition of his friend Girolamo Benivieni, entitled *Una Canzona de Amore secundo la mente et openione de' Platonici*, "A poetical treatise upon love, explaining the doctrines of the Platonists." The author, Girolamo, informs the reader, in a short preface, that he had determined to suppress this poem and comment out of regard to his friend's character and his own; deeming it unbecoming a professor of Christianity, in treating of celestial and divine love, "to treat of it as a Platonist and not as a Christian;" but that having lent it to some of his friends for their perusal, an imperfect and erroneous copy was printed, which obliged him, but not till after the death of Mirandola, to publish it correctly; and he takes care to allege, in excuse for himself, that he has apprized the reader of his plan by the title of the poem, and warned him in all places where Plato's opinions depart from those of Christ, that the doctrines of a gentile and a heathen are not entitled to the least weight compared with the reasonings of the Christian theologists, "and particularly the irrefragable arguments of the angelic doctor St Thomas of Aquino."

The first fruit of Mirandola's devotion to sacred literature was the Heptaplus, or Comment upon the Six Days of the first Chapter of Genesis, which was written in 1491. Two years afterwards he published a treatise in ten chapters, *de Ente et Uno*; the object of which was to reconcile the doctrines of Plato and Aristotle, and to demonstrate that the disputes of their respective followers originated in a misconception of the opinions of these philosophers relative to the *Ens* and *Unum*, at that time a subject of mighty strife among the learned. This treatise was held in high esteem by both sides. It was the last work of consequence that the author lived to complete; but he had laid the plan of a vast and comprehensive work, which his early death prevented the execution of. This was no less than to confound the seven enemies of the Christian church, by examining and refuting all their errors. In the prosecution of this design, he had composed and perfected before his death twelve books against astrology, the most popular and the most pernicious superstition which then infested the world. Paulus Jovius, bishop of Nocera, has left a testimony to the merits of this work, which is above all other encomiums:—"In this excellent though unfinished work, Mirandola attacked the astrologers with such erudition and keenness, and so ably exposed the absurdity and vanity of the whole art of divination, that he seems to have deterred the professors of the occult sciences from writing*."

This great design, as well as many others which Mirandola had formed, particularly that of a more complete essay towards reconciling the opinions of Plato and Aristotle, was frustrated by his death. From the time that he left Rome, which was soon after the publication of the Apologia, Mirandola generally resided either at Ferrara or at Florence. The friendship of the prince of Ferrara and its vicinity to his paternal seat attracted him to the former place; but Florence was the most agreeable to him, on account of the society of literary men which it afforded, and particularly of *Politian* and *Lorenzo de Medici*, with whom he entertained a close friendship. Besides these two illustrious men, his society was cultivated by other eminent scholars, among whom was the learned and unfortunate Hieronymus Savanarola, and Hermolaus Barbarus: Petrus Crinitus, the pupil of Politian†, mentions him as excelling all his companions in the erudition and eloquence of his conversation. The same author has left us an account of Pica's laborious studies; for when Politian had expressed in his presence high admiration of his great genius and learning, Mirandola with singular modesty answered, that he deserved no praise but for his assiduous application—"Gratulandum potius, intelligite, assiduis vigiliis atque lucubrationibus, quam nostro ingenio plaudendum‡."

His library likewise is celebrated by the same writer, and is said by Francisco de Mirandola to have cost 7000 pieces of gold. His accomplishments were not confined to subjects of abstruse literature; in his youth he was much attached to music, in which he acquired such skill, that some of his melodies were publicly received, and held in great esteem. It might also be concluded, from an anecdote related by Petrus Crinitus, that he was not unacquainted with physic; for according to that author, when Hermolaus Barbarus was seized at Rome with a dangerous fever, Mirandola sent him from Florence a medicine prepared by himself. No man ever testified a more sincere devotion for learning and philosophy, to the contempt of all other qualifications, than the Prince of Mirandola. He possessed a very large estate, which he bestowed almost entirely upon works of charity, except what was spent in collecting books, and entertaining and providing for literary men. At length, however, about three years before his death, he made over to his nephew Francisco his principality and possessions in Mirandola, and obtained a confirmation of the grant from Maximilian, the Roman emperor, to whom that principality was subject. He reserved to himself only enough to purchase a small estate near Ferrara, where he spent the remainder of his life, except when he resided at Florence, in elegant and learned retirement. His mother, under whose care he received his education, had destined him for the church; and he was often urged by his friends to embrace the sacred profession, with the certainty of the highest honours and emoluments: but nothing could induce him to quit the life that he had chosen. He died of a fever at Florence, in the year 1494, in the 31st year of his age, on the same day that Charles IX. of France entered that city on his famous expedition into Italy. That monarch, hearing of Mirandola's illness, as he approached the city, sent two of his own physicians to his assistance; but in spite of their aid, the violence of his disorder put an end to his existence in 13 days.

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* Paul. Jov. Elog. Doct. Vir. p. 92.

† P. Crinitus de honesta Discip. lib. iii c. i. lib. v. c. 1. & lib. ii c. 2.

‡ Ib. lib. ii c. 2.

With respect to the works of this author, something has already been said, and little more remains to be observed. The *Conclusiones* afford a very complete specimen of the learning of the age, and of what were deemed the most valuable purposes to which learning could be applied. However useless and unprofitable these purposes may appear to us, it will not be denied by any one, who has the curiosity to look through the *Conclusiones*, that the mass of learning, which must have been possessed by the proposer of them, is prodigious; when it is recollected that, at the time he proposed them, he was no more than 23 years of age. For there is not the least reason to suppose, that a person whose works prove him to have been a man of profound learning, and who, in an age and nation distinguished by some of the brightest scholars that ever appeared, was ranked by their own judgment amongst the first, should have challenged the discussion of any of the proposed subjects, without being well provided with the knowledge necessary for such a debate. The manner in which the questions were propounded leave little room to doubt that the author was deeply versed in the respective subjects of them; and the Apology for the accused propositions, particularly those *de Salute Origenis* and *de Magiâ atque Cabalâ*, discover familiarity with the writings of the Fathers, as well as with the Greek and Hebrew classics, and a facility of language and argument that could not be acquired at that age without extraordinary powers of mind. It would be worth while to transcribe the whole of this curious piece for the amusement of such of our readers as may not have access to the original, but our limits do not admit of it.

It is curious to observe how greatly the sudden growth of learning outstripped that of solid science. No age, perhaps, was ever so remarkable for the learning which it produced as the period from the middle of the 15th century to the beginning of the 16th; yet, except the inestimable obligations we owe to the learned men of that time for their editions of the classics, later ages have been little benefited by their works, which are either lost or neglected, and even the sciences they treated of exploded and ridiculed. School-divinity and metaphysics, though the most attended to, were not the only studies in which the vast erudition of that age was wasted. The mysterious doctrines of the Cabala formed a favourite study of some of the most learned scholars. The proposition which laid Pica open to the indignation of the church, was that in which he asserted the orthodoxy of Origen; for Origen, notwithstanding his meritorious labours in the cause of Christianity, his daring zeal and self-martyrdom, and notwithstanding the defence of Eusebius, was consigned by the sentence of the church to inevitable damnation, on account of his errors in the mysteries of the faith. To question his perdition, therefore, was to deny that the church was the interpreter of the divine intentions. The defence of this part of the *Conclusiones* is written with a boldness that could hardly be expected from an Italian of the 15th century. But the hardiest of these propositions was that in which it is asserted, that faith is not in a man's own power. In defending this and the other propositions, which were taxed with heresy, Pica probably relied less on the spirit and ability of his justification, than on his own high rank and station, together with the countenance and protection of his powerful friends, particularly the Medici, whose liberality of sentiment in regard to religious points was so notorious, that even Leo. X. has been directly charged, not only with heresy, but infidelity *.

* *Milner's Hist. of the Church*, vol. iv.

By the Cabala, a term at this time generally misapprehended, was understood sometimes a species of divine magic operating by the agency of good spirits, as magic commonly so called was supposed to do by that of evil beings; but the true definition of it, as received by the best of its professors, is given by Reuchlinus (A), in his treatise addressed to Lorenzo de Medici, *Divinæ Revelationis ad salutiferam Dei et formarum separatarum contemplationem traditæ symbolica receptio*,—a symbolic acceptation of the Mosaic history (for that is meant by *divina revelatio*) which produced a pure and perfect acquaintance with the nature of the divinity and of spirits; and according to the opinions of some, which seem to be revived by the modern Swedenborgians, this knowledge, when sublimed to the highest perfection it was capable of, and accompanied with perfect purity, was believed

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(A) This treatise, which contains the whole learning upon a subject once held in the highest veneration by men of learning, is very curious, and is to be found in the folio edition of Mirandola's works, published at Basil in 1557.

to raise the mind to an absolute familiarity with good angels, by whose assistance the possessors of the cabalic secrets were enabled to do miraculous things. This art was derived from the rabbinical doctors, who were at first called Thalmudists; and, about the middle of the 15th century, according to Pica de Mirandola *, its professors were denominated Cabalici, Cabalæi, or Cabalistæ, according to their different degrees of perfection: they afterwards, however, departed from their masters the Thalmudists; the latter, according to Reuchlinus, being chiefly intent upon the law and the explanation of it, while the former, paying less regard to what concerned human affairs, aimed chiefly at elevation of mind and thought. The ideas and doctrines of the Cabalists seem to have been well known to Milton, and perhaps suggested some passages in Paradise Lost. In Reuchlinus's Exposition of their mysteries there is a curious passage describing the speech of the Deity to the heavenly spirits after the fall of Adam, with the future prospect of redemption by the incarnation of the Messiah, whom the Cabalists recognised in the character of a celestial Adam (B); and, among the books relating to these doctrines, which are said to be lost, mention is made of *Liber Bellorum Domini*. The mysteries of the Pythagorean philosophy, which, according to Philolaus apud Reuchlinum, sprung from the same source, were also studied and taught with great fervency during this period. Mirandola and Paulus Riccius were the first who explained the Cabalistic mysteries in Latin, and the former in his Apology, has employed much labour and learning in defending them, as well as the science of natural magic, from the vulgar idea that necromancy was at the bottom of them. His writings, however, upon that subject were few, and we do not know whether they still exist; but it may be collected from the following proposition in his *Conclusiones*, and some others of a similar nature, that he, like all the scholars of his time, had bestowed much attention upon this useless learning: "Qui scierit quid sit denarius in Arithmetica formali, et cognoverit natura primi numeri sphærici, sciet secretum quinquaginta portarum intelligentiæ et magni jobelæi, et millesimæ generationis, et regnum omnium seculorum." Those who are well acquainted with the tenets of the modern millenarians will be able to tell whether there be any connection between them and the allusions in the concluding part of this proposition.

* *Reuchlinus de Arte Cabalist.*

Magic also entered deeply into the learning of this era. This comprises two distinct sciences, that of natural magic, and that of dæmonology: the first was concerned only in the properties of numbers and figures, and some of the more hidden properties of nature. This knowledge enabled its possessors to produce many effects from natural causes, which, when science was less diffused than at present, appeared to be the effect of something superior to the common limits of human power. Albertus, commonly called Magnus, the friend and tutor of Roger Bacon, was the most celebrated of those who excelled in this sort of knowledge. This science has been productive of many admirable discoveries in mathematics and chemistry. Magic, in its common signification, or necromancy, was also eagerly studied at this time, as appears from Cornelius Agrippa's strange work upon that subject; and we may judge of the estimation in which it was held, by the confession that writer makes in his book *De vanitate omnium Scientiarum*, that while he professed that science, he derived more credit and profit from it, than from any other use he ever could make of his learning. The first master in this way was said to be * Solomon, whose magic ring and glass are still famous in eastern dæmonology.

* *P. Crinitus de honesta Discip.* lib. ix. c. 5

But the most dangerous, the most popular, and the most pernicious delusion which the darkness of the preceding ages had entailed upon mankind, was astrology, which will perhaps never be utterly exterminated from the minds of the vulgar, but which then possessed all ranks. When these considerations are taken into the account, it must be looked upon as no despicable application of learning and talents, to have exposed the fallacy and absurdity of this delusion; and when we recollect the great learning and credit of some of its upholders, among whom our countryman Roger Bacon was the most esteemed; the almost universal belief entertained of it, and the few lights which mankind then possessed, as to the real and constant laws obeyed by the celestial bodies; it cannot be denied that the twelve books written by Mirandola against astrology, the effect of which, in opening men's eyes upon that subject is testified by a respectable cotemporary author, were the work of a very superior and enlightened mind. When we congratulate ourselves upon our freedom from these superstitions, we ought not to forget, that we owe something to those who gave the first blow to them. Proud of the lights of the age we live in, when astrology and such like cheats are no longer in vogue, we are too apt to overlook the merit of those exertions which first exposed and refuted them; and to persuade ourselves, that in these days of genius and philosophy, such exertions would have been unnecessary; not recollecting that if we enjoy many superiorities of this kind, we are less indebted for them to our own genius than to the labours of those who first paved the way for the detection of superstitious errors; our merit is, that we do not shut our eyes to the light of science; but while we enjoy its blaze, we ought to be grateful to those who struck the first sparks.

John Pica of Mirandola has been represented by writers, whose ideas are taken from the encomiums of his cotemporaries, as a mighty prodigy of learning and genius. The distaste which the present times entertain towards those subjects upon which he wrote, renders it very difficult, upon a review of his works, to think those encomiums justified. But making allowance for this change of opinion, and weighing the impartial testimony of his equals, and the early age at which he obtained their admiration, it may be fairly concluded, he was in reality, a man of very extraordinary powers. These memoirs are principally collected from his letters, and the account given of him by his nephew Francisco, himself

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(c) Conjicimus sane, alterum esse Adam cælestem angelis in cœlo demonstratum, unum ex Deo, quem verbo fecerat et alterum esse Adam terrenum, repulsum à Deo, quem ex luto manibus suis finxerat. *Reuchlinus*, p. 750.

self an eminent scholar. Such a biographer might naturally be suspected of partiality; but the evidence of other writers fully confirms his account. Paulus Jovius, in his *Elogia Doctorum Virorum*, gives the following character of him [*]. "John Pica of Mirandola, has been justly styled the phœnix; for in him, the immortal gods, besides the splendour of his family, assembled all the rarest gifts of body and mind."

Petrus Riccius, commonly called Petrus Crinitus, who was the pupil of Politian and the companion of Mirandola, laments the death of him and Politian, which happened in the same year, as a public misfortune, more severely felt at that particular time, when learning, obstructed by the incursion of the French into Italy, wanted the support and assistance of such men [‡]. To these may be added the testimony of Hieronymus Savanarola, who, though afterwards put to death by Pope Alexander for a heretic, was a man of great consideration on account of his learning and talents. In a dispute which took place between him and Mirandola, concerning the philosophy of the ancients; the former, yielding to the superiority of his opponent, rose up and embracing him said, "Unus tu es, Pice, ætate nostra qui omnium veterum philosophiam ac religionis Christianæ præcepta et leges percalleas [‖]. The following epitaph, written by Hercules Strozza, is preserved by Paulus Jovius:

Joannes jacet hic Mirandola; cætera norunt
Et Tagus et Ganges, forsan et Antipodes.

Dr Johnson in his Essay on Epitaphs, has taken notice of this pompous distich, as a warning to epitaph writers. "Thus, says he, have their expectations been disappointed, who honoured Picus of Mirandola with this pompous epitaph. His name, then celebrated in the remotest corners of the earth, is now almost forgotten; and his works, then studied, admired, and applauded, are now mouldering in obscurity." *Monthly Mag.*

PICARD, a native of the Netherlands, who founded a sect the professors of which were called *Picards*. See **Picards**.

Picard, *John*, an able mathematician, and one of the most learned astronomers of the 17th century, was born at Fleche, and became priest and prior of Rillie in Anjou. Going to Paris, he was in 1666 received into the Academy of Sciences in quality of astronomer. In 1671, he was sent, by order of the king, to the castle of Uraniburg, built by Tycho Brahe in Denmark, to make astronomical observations there; and from thence he brought the original manuscripts wrote by Tycho Brahe, which are the more valuable as they differ in many places from the printed copies, and contain a book more than has yet appeared. He made important discoveries in astronomy; and was the first who travelled through several parts of France, to measure a degree of the meridian. His works are, 1. A treatise on levelling. 2. Fragments of dioptrics. 3. *Experimenta circa aquas effluentes*. 4. *De mensuris*. 5. *De mensura liquidorum & aridorum*. 6. A voyage to Uraniburg, or astronomical observations made in Denmark. 7. Astronomical observations made in several parts of France, &c. These, and some other of his works, which are much esteemed, are in the sixth and seven volumes of the Memoirs of the Academy of Sciences.

PICARDS, a religious sect which arose in Bohemia in the 15th century.

Picard, the author of this sect, from whom it derived its name, drew after him, as has been generally said, a number of men and women, pretending he would restore them to the primitive state of innocence wherein man was created: and accordingly he assumed the title of the *New Adam*. With this pretence he taught his followers to give themselves up to all impurity; saying that therein consisted the liberty of the sons of God; and that all those not of their sect were in bondage. He first published his notions in Germany and the Low Countries, and persuaded many people to go naked, and gave them the name of *Adamites*. After this he seized on an island in the river Lausnecz, some leagues from Thabor, the head quarters of Zisca, where he fixed himself and his followers. His women were common, but none were allowed to enjoy them without his permission: so that when any man desired a particular woman, he carried her to Picard, who gave him leave in these words, *Go, increase, multiply, and fill the earth.*

At length, however, Zisca, general of the Hussites, (famous for his victories over the emperor Sigismund), hurt at their abominations, marched against them, made himself master of their island, and put them all to death except two; whom he spared, that he might learn their doctrine.

Such is the account which various writers, relying on the authorities of Æneas Sylvius and Varillas, have given of the Picards, who appear to have been a party of the Vaudois, that fled from persecution in their own country, and sought refuge in Bohemia. It is indeed doubtful whether a sect of this denomination, chargeable with such wild principles and such licentious conduct, ever existed; and it is certainly astonishing that Mr Bayle, in his art. *Picards*, should adopt the reproachful representations of the writers just mentioned: for it appears probable at least that the whole is a calumny invented and propagated in order to disgrace the Picards, merely because they deserted the communion and protested against the errors of the church of Rome. Lasitius informs us, that Picard, together with 40 other persons, besides women and children, settled in Bohemia in the year 1418. Balbinus the Jesuit, in his *Epitome Rerum Bohemicarum*, lib. ii. gives a similar account, and charges on the Picards none of the extravagancies or crimes ascribed to them by Sylvius. Schlecta, secretary of Ladislaus, king of Bohemia, in his letters to Erasmus, in which he gives a particular account of the Picards, says that they considered the pope, cardinals, and bishops of Rome, as the true Antichrists, and the adorers of the consecrated elements in the eucharist as downright idolaters; that they denied the corporeal presence of Christ in this ordinance; that they condemned the worship of saints, prayers for the dead, auricular confession, the penance imposed by priests, the feasts and vigils observed in the Romish church; and that they confined themselves to the observance of the sabbath, and of the two great feasts of Christmas and Pentecost. From this account it would appear that they were no other than the Vaudois; and M. de Beausobre has shewn that they were both of the same sect, though under different denominations. Besides, it is certain that the Vaudois were

[*] P. 92.

[‡] Pet. Crin. de honesta Discip.

[‖] Ib. iii. c. 2.

were settled in Bohemia in the year 1178, where some of them adopted the rites of the Greek, and others those of the Latin church. The former were pretty generally adhered to till the middle of the 14th century, when the establishment of the Latin rites caused great disturbance. On the commencement of the national troubles in Bohemia, on account of the opposition to the papal power (see MORAVIANS), the Picards more publicly avowed and defended their religious opinions; and they formed a considerable body in an island by the river Launitz or Lausnecz, in the district of Bechin, and recurring to arms, were defeated by Zisca. *Encyclop.* art. Picards.

PICARDY, a province in France, is bounded on the north by Hainault, Artois, and the straits of Calais; on the east by Champagne; on the south by the Isle of France; and on the west by Normandy and the English channel (A). This province is long and narrow, being usually compared to a bent arm; and in this figure is nearly 150 miles in length, but not above 40 in breadth, and in many places not above 20. It is generally a level country; and produces wine, fruit of all kinds, plenty of corn, and great quantities of hay: but wood being scarce, most of the inhabitants burn turf. They have, however, some pit-coal, but it is not so good as that of England. It was united to the crown of France in the year 1643. It nearly corresponds with the present department of the Somme.

Its principal rivers are the Somme, the Oise, the Canche, the Lanthie, the Lys, the Aa, the Scarpe, and the Deule.

The situation of this province on the sea, its many navigable rivers and canals, with the industry of the inhabitants, render it the seat of a flourishing trade. In it are many beautiful silk stuffs, woollen stuffs, coarse linen, lawn, and soap; it also carries on a large trade in corn and pit coal. In the districts of Calais and Boulogne are annually bred 5000 or 6000 colts, which being afterwards turned loose in the pastures of Normandy, are sold for Norman horses. The fisheries on this coast are also very advantageous. This province was formerly divided into Upper, Middle, and Lower Picardy, and again subdivided into four deputy governments. The principal town is Amiens.

PICCOLOMINI, ALEXANDER, archbishop of Patras, and a native of Sienna, where he was born about the year 1508, was of an illustrious and ancient family, which came originally from Rome, but afterwards settled at Sienna. He composed with success for the theatre; but he was not more distinguished by his genius, than by the purity of his manners, and his regard to virtue. His charity was very great; and was chiefly exerted in relieving the necessities of men of letters. He has left behind him a number of works in Italian; the most remarkable of which are, 1. Various Dramatic pieces, which laid the first foundation of his character as a writer. 2. A Treatise on the Sphere. 3. A Theory of the Planets. 4. A Translation of Aristotle's Art of Rhetoric and Poetry, in 4to. 5. A System of Morality published at Venice, 1575, in 4to; translated into French by Peter de Larivey in 4to; and printed at Paris, 1581. These, with a variety of other works, prove his extensive knowledge in natural philosophy, mathematics, and theology. He was the first who made use of the Italian language in writing upon philosophical subjects. He died at Sienna the 12th of March 1578, aged 70. A particular catalogue of his works may be seen in the Typographical Dictionary. There is one performance ascribed to this author, entitled *Dialogo della bella Creanta delle Donne*, (printed at Milan, 1558, and at Venice, 1574, in 8vo.); which but ill suits the dignity of a prelate. It is filled with maxims which have an evident tendency to hurt the morals of young women. Piccolomini's name, indeed, is not in the title page; and it has all the appearance of being a juvenile production. It is very scarce; and the public would sustain no loss by its being entirely out of print. It was translated into French by F. d'Amboise, and published at Lyons, in 16mo, under the title of *Instruction des jeunes dames*. It was afterwards reprinted in 1583, under that of *Dialogue et Devis des Demoiselles*.

PICCOLOMINI, *Francis*, of the same family with the foregoing, was born in 1520, and taught philosophy with success for the space of 22 years, in the most celebrated universities of Italy, and afterwards retired to Sienna, where he died, in 1604, at the age of 84. This city went into mourning on his death. His works are, 1. Some Commentaries upon Aristotle, printed at Mayence, 1608, in 4to. 2. *Universa Philosophia de Moribus*, printed at Venice, 1583, in folio. He laboured to revive the doctrine of Plato, and endeavoured also to imitate the manners of that philosopher. He had for his rival the famous James Zabarella, whom he excelled in facility of expression and neatness of discourse; but to whom he was much inferior in point of argument, because he did not examine matters to the bottom as the other did, but passed too rapidly from one proposition to another.

PICCOLOMINI of *Arragon*, *Octavius*, duke of Amalfi, prince of the empire, a general of the emperor's army, and knight of the order of the Golden Fleece, was born in 1599. He first bore arms among the Spanish troops in Italy. He afterwards served in the army of Ferdinand II. who sent him to the relief of Bohemia, and entrusted him with the command of the imperial troops in 1634. After having signalized himself at the battle of Nortlingue, he made Marshal de Chatillon raise the siege of St Omer. He had the good fortune to gain a victory over Marquis de Feuquieres in 1639: nor did the loss of the battle of Wolfenbuttle, in 1651, impair his glory. He died on the 10th of August 1656, being five years after, aged 57, without issue; and with the character of an able negotiator and an active general. The celebrated Caprara was his nephew.

PICCOLOMINI,

(A) The origin of the name of this province does not date earlier than A. D. 1200. It was an academical joke; an epithet first applied to the quarrelsome humour of those students in the university of Paris who came from the frontier of France and Flanders, and hence to their country. *Valesii Notitia Galliarum*, p. 447. *Longuerac, Description de la France*, p. 52.

Piccolomini, *James*, whose proper name was *Ammanati*, took that of *Piccolomini* in honour of his patron Pius II. He was born in a village near Lucca in 1422. He became bishop of Massa, afterwards of Frescati; a cardinal in 1461, under the name of *Cardinal de Pavie*; and died in 1479, at the age of 57, of an indigestion of figs. He left 8000 pistoles in the bankers hands, which Pope Sixtus IV. claimed; and of which he gave a part to the Hospital of the Holy Ghost. His works, which consist of some Letters, and a history of his own time, were printed at Milan, in 1521, in folio. His history, entitled *Commentaries*, commences the 18th of June 1464, and ends the 6th of December 1469. They may very properly be considered as a Sequel of Pope Pius II.'s Commentaries, which end with the year 1463.

Piccolomini, Æneas Sylvius. See Pius II.

PICENTIA, (Strabo, Pliny), the capital of the Picentini, whose territory, called *Ager Picentinus*, a small district, lay on the Tuscan sea, from the *Promontorium Minervæ*, the south boundary of Campania on the coast, to the river Silarus, the north boundary of Lucania, extending within-land as far as the Samnites and Hirpini, though the exact termination cannot be assigned. The Greeks commonly confound the *Pincentini* and *Picentes*, but the Romans carefully distinguish them. The former, with no more than two towns that can be named, *Silernum* and *Picentia*; the situation of both doubtful: only Pliny says the latter stood within-land, at some distance from the sea. Now thought to be *Bicenza*, (Holstenius), in the Principato Citra of Naples.

PICENUM, (Cæsar, Pliny, Florus); Picenus Ager, (Cicero, Sallust, Livy, Tacitus); *Ager Picentium*, (Varro): a territory of Italy, lying to the east of Umbria, from the Apennine to the Adriatic; on the coast extending from the river Aesis on the north, as far as the *Prætutiani* to the south. In the upper or northern part of their territory the Umbri excluded them from the Appennine, as far as Camerinum, (Strabo); but in the lower or southern part they extended from the Adriatic to the Apennine. A very fruitful territory, and very populous. *Picentes*, the people, (Cicero); from the singular *Picens*, (Livy): different from the *Picentini* on the Tuscan sea, though called so by the Greeks; but Ptolemy calls them *Piceni*, as does also Pliny. Their territory at this day is supposed to form the greatest part of the March of Ancona, (Cluverius).

PICHFORD, in the county of Salop in England; on the south-east side of Shrewsbury, near Condover. It is noted for a spring of pitchy water (from whence some derive its name), on the top of which there always flows a sort of liquid bitumen. Over most of the coal pits in this neighbourhood there lies a stratum of blackish rock; of which, by boiling and grinding, they make pitch and tar, and also distil an oil from it.

PICHINCHA, or Pinchinca, a mountain in Peru. See Peru, N° 56.

PICKERING, in the north riding of Yorkshire in England, 13 miles from Scarborough, and 125 from London, is a pretty large town belonging to the duchy of Lancaster, on a hill among the wild mountains of Blakemore; having the forest of Pickering on the north, and Pickering-common on the south. It is said to have been built 270 years before Christ by Peridurus, a king of the Britons, who was buried here. It had once a castle, the ruins of which are still to be seen; to whose jurisdiction many of the neighbouring villages were subject: and the adjacent territory, commonly called Pickering-Lath, or the liberty or forest of Pickering, was given by Henry III. to his son Edmund earl of Lancaster. A court is kept here for all actions under 40s. arising within the honour of Pickering.

PICKERY, in *Scots Law*, petty theft, or stealing things of small value.

PICKETS, in fortification, stakes sharp at one end, and sometimes shod with iron, used in laying out the ground, of about three feet long; but, when used for pinning the fascines of a battery, they are from three to five feet long.

Pickets, in artillery, are about five or six feet long, shod with iron, to pin the park lines, in laying out the boundaries of the park.

Pickets, in the camp, are also stakes of about six or eight inches long, to fasten the tent cords, in pitching the tents; also of about four or five feet long, driven into the ground near the tents of the horsemen, to tie their horses to.

Picket, an out-guard posted before an army, to give notice of an enemy approaching.

Picket, a kind of punishment so called, where a soldier stands with one foot upon a sharp-pointed stake; the time of his standing is limited according to the offence.

PICKLE, a brine or liquor, commonly composed of salt, vinegar, &c. sometimes with the addition of spices, wherein meat, fruit, and other things, are preserved and seasoned.

PICO, one of the Azores islands, is so called from some lofty mountains on it; or rather from one very high mountain, terminating like Teneriffe in a peak, and reputed by some writers equal to it in height. This island lies about four leagues south-west from St George, twelve from Tercera, and about three leagues south-east of Fayal; in W. Long. 28. 21. and N. Lat. 38. 29. The mountain Pico, which gives name to the island, is filled with dismal dark caverns or volcanoes, which frequently vomit out flames, smoke, and ashes, to a great distance. At the foot of this mountain towards the east is a spring of fresh water, generally cold, but sometimes so heated with the subterraneous fire, as to rush forth in torrents with a kind of ebullition like boiling water; equalling that in heat, and sending forth a steam of sulphureous fetid vapours, liquefied stones, minerals, and flakes of earth, all on fire, in such quantities, and with such a violence, as to have formed a kind of promontory vulgarly called *Mysterios*, on the declivity of the coast, and at the distance of 1200 paces from the fountain. Such at least is the account of Ortelius; though we do not find this last circumstance of the promontory confirmed by later observations. The circumference of Pico is computed at about 15 leagues: and its most remarkable places are Pico, Lagoas, Santa Cruce or Cruz, San Sebastian, Pesquin, San Roko, Playa, and Magdalena; the inhabitants of which live wholly on the produce of the island, in great plenty and felicity. The cattle are various, numerous, and excellent in their several kinds: it is the same with the vine; and its juice, prepared into different wines, the best in the Azores.

Besides cedar and other timber, they have a kind of wood which they call *teixo*, solid and hard as iron; and veined, when finely polished, like a rich scarlet tabby; which colour it has in great perfection. The longer it is kept, the more beautiful it grows: hence it is, that the teixo tree is felled only for the king's use or by his order; and is prohibited from being exported as a common article of trade.

Mod. Univ. History vol xiii. p. 46. &c.

Pico *Marino*, a sea fish common at Kongo in Africa, derives its name from the resemblance of its mouth to the beak of a woodpecker. It is of large size, and prodigious strength, has four fins on its back, three under its belly, and one on each side of its head; its tail is large and forked, by which it cuts the waves with surprising force and velocity. It is at war with every fish that swims, and with every thing it meets in its way, without being intimidated by the largest vessels; a surprising instance of which intrepidity, we are told by some missionaries, whose ship was attacked by one of them, near these coasts, in the dead of night. The violence of the shock which it gave to the vessel quickly awakened the captain and the rest of the people; who immediately ran to the ship's side, where they perceived, by moonlight, this huge monster fastened by its forehead to the vessel, and making the strongest efforts to disengage itself; upon which some of them tried to pierce him with their pikes, but he got off before they could accomplish their aim. On the next morning, upon visiting that side of the vessel, they found a piece of the bony snout stuck fast into the wood, and two or three inches of it projecting outwards. In the inside of the ship, there was discovered about five or six inches more of the point of the horn, which had penetrated through the plank. But we must observe, that the credulity of the times probably rendered this animal thus formidable.

PICQUERING, flying war, or skirmish, made by soldiers detached from two armies for pillage, or before a main battle begins.

PICQUET, or Picket. See Piquet.

PICRAMNIA, a genus of plants belonging to the diœcia class; and in the natural method ranking with those that are doubtful. See Botany *Index*.

PICRANIA amara, or *Bitter Wood*, is a tall and beautiful timber tree, common in the woods of Jamaica, belonging to the pentandria class of plants. The name is expressive of its sensible qualities.

Every part of this tree is intensely bitter; and even after the tree has been laid for floors many years, whoever rubs or scrapes the wood, feels a great degree of bitterness in their mouth or throat. Cabinet-work made of this wood is very useful, as no insect will live near it.

This tree has a great affinity to the *Quassia Amara* of Linnæus; in lieu of which it is used as an antiseptic in putrid fevers. When used, less of it will do than of the *Quassia Amara* of Surinam. See Quassia, Botany and Materia Medica *Index*.

PICRIS, Ox-tongue; a genus of plants belonging to the syngenesia class. See Botany *Index*.

PICRIUM, a genus of plants belonging to the tetandria class; and in the natural method ranking with those that are doubtful. See Botany *Index*.

PICTET, Benedict, a celebrated divine, was born at Geneva, in 1655, of a distinguished family, and prosecuted his studies with great success. After having travelled into Holland and England, he taught theology in his own country with an extraordinary reputation. The university of Leyden, after the death of Spantreina, solicited him to come and fill his place; but he thought that his own country had the best right to his services; and for that generosity he received its thanks by the mouth of the members of council. A languishing disorder, occasioned by too much fatigue, hastened his death: which happened on the 9th of June 1724, at the age of 69 years. This minister had much sweetness and affability in his manner. The poor found in him a comforter and a father. He published a great number of works in Latin and French, which are much esteemed in Protestant countries. The principal of these are, 1. A System of Christian Theology in Latin, 3 vols. in 4to; the best edition of which is that of 1721. 2. Christian Morality, printed at Geneva, 1710, 8 vols. in 12mo. 3. The History of the 11th and 12th centuries; intended as a sequel to that of Sueur, printed in 1713, 2 vols. in 4to. The Continuator is held in higher estimation than the first author. 4. Several Controversial Treatises. 5. A great number of tracts on morality and piety; among which we must distinguish "the Art of Living and Dying well;" published at Geneva, 1705, in 12mo. 6. Some Letters. 7. Some Sermons, from 1697 to 1721; 4 vols. in 8vo. With a vast number of other books, the names of which it would be tedious to mention; but which, as Mr Sennebier says, "all show evident marks of piety and good sense."

PICTET, *John-Louis*, a counsellor of Geneva, born in 1739, was of the same family. He was member of the Council of Two Hundred; counsellor of State and Syndic; and died in 1781. He applied himself to the study of astronomy, and made several voyages into France and England for his improvement. Few men were ever blessed with a clearer or more enlightened understanding. He has left in manuscript the "Journal of a Voyage which he made to Russia and Siberia in 1768 and 1769, in order to observe the transit of Venus over the sun's disk:" A work very interesting, from the lively descriptions which it gives both of men and of nature.

PICTLAND. See Pentland.

1 Name.

PICTS, the name of one of those nations who anciently possessed the north of Britain. It is generally believed that they were so called from their custom of painting their bodies; an opinion which Camden supports with great erudition. (See Gough's edition, Vol. I. p. xci. of the preface). It is certainly liable, however, to considerable objections; for as this custom prevailed among the other ancient inhabitants of Britain, who used the *glastum* of Pliny and the *vitrum* of Mela for the like purpose, it may be asked, Why the name of *Picti* was confined by the Romans to only one tribe, when it was equally applicable to many others? Why should they design them only by an epithet, without ever annexing their proper name? Or why should they impose a new name on this people only, when they give their proper name to every other tribe which they have occasion to speak of? As these questions cannot be answered in any satisfactory manner, it is plain we must look for some other derivation of the name.

The Highlanders of Scotland, who speak the ancient language of Caledonia, express the name of this once famous nation by the term *Pictich*; a name familiar to the ears of the most illiterate, who could never have derived it from the Roman authors. The word *Pictich* means *pilferers* or *plunderers*. The appellation was probably imposed upon this people by their neighbours, or assumed by themselves, some time after the reign of Caracalla, when the unguarded state of the Roman province, on which this people bordered, gave them frequent opportunities of making incursions thither, and committing depredations. Accordingly this name seems to have been unknown till the end of the 3d century. Eumenius the panegyrist is the first Roman author who mentions this people under their new name of *Pictich*, or, with a Latin termination, *Picti*. When we say that this name may have been probably assumed for the reason just now mentioned, we must observe, that, in those days of violence, the character of a robber was attended with no disgrace. If he had the address to form his schemes well, and to execute them successfully, he was rather praised than blamed for his conduct; providing he made no encroachments on the property of his own tribe or any of its allies. We mean this as no peculiar stigma upon the Picts; for other nations of antiquity, in the like rude state, thought and acted as they did. See *Thucydides*, lib. iii. p. 3. and *Virg. Æn.* vii. 745 et 749.

2 **Origin.** Concerning the origin of the Picts, authors are much divided. Boethius derives them from the Agathyrsi, Pomponius Lætus from the Germans, Bede from the Scythians, Camden (A) and Father Innes from the ancient Britons, Stillingfleet from a people inhabiting the Cimbrica Chersonesus, and Keating and O'Flaherty, on the authority of the Cashel Psalter, derive them from the Thracians. But the most probable opinion is, that they were the descendants of the old Caledonians. Several reasons are urged in support of this opinion by Dr Macpherson; and the words of Eumenes, "Caledonum, aliorumque Pictorum, silvus," &c. plainly imply that the Picts and Caledonians were one and the same people.

3 **Language.** As there has been much dispute about the origin of the Picts, so there has been likewise about their language. There are many reasons which make it plain that their tongue was the Gaelic or Celtic; and these reasons are a further confirmation of their having been of Caledonian extract. Through the east and north-east coasts of Scotland (which were possessed by the Picts) we meet with an innumerable list of names of places, rivers, mountains, &c. which are manifestly Gaelic. From a very old register of the priory of St Andrew's (Dalrymple's Collections, p. 122.) it appears, that in the days of Hungus, the last Pictish king of that name, St Andrew's was called *Mukross*; and that the town now called *Queensferry* had the name of *Ardchinneachan*. Both these words are plain Gaelic. The first signifies "the heath or promontory of boars;" and the latter, "the height or peninsula of Kenneth." In the list of Pictish kings published by Father Innes, most of the names are obviously Gaelic, and in many instances the same with the names in the list of Scottish or Caledonian kings published by the same author. Had Innes understood any thing of this language, he would not have supposed with Camden that the Picts spoke the British tongue. It was unlucky that the two words on which they built their conjecture (*Strath* and *Aber*) are as common in the Gaelic as they could have been in the British, and at this day make a part of the names of places in countries to which the Pictish empire never extended. The names of *Strathfillan* and *Lochaber* may serve as instances.

The venerable Bede, as much a stranger to the Celtic as either of the antiquaries just now mentioned, is equally unhappy in the specimen which he gives of the Pictish language in the word *penuahel*, "the head of the wall." Allowing the commutation of the initial *p* into *c*, as in some other cases, this word has still the same meaning in Gaelic which Bede gives it in the Pictish. It is true, there might have been then, as well as now, a considerable difference between various dialects of the Celtic; and thus, perhaps, that pious author was led to discover five languages in Britain *agreeably to the five books of Moses*: A conceit from which the good man derived a great deal of harmless satisfaction.

4 **Territory.** The Picts of the earliest ages, as appears from the joint testimony of all writers who have examined the subject, possessed only the east and north-east coast of Scotland. On one side, the ancient Drumalbin, or that ridge of mountains reaching from Lochlomond near Dumbarton to the frith of Tain, which separates the county of Sutherland from a part of Ross, was the boundary of the Pictish dominions. Accordingly we find in the life of Columba, that, in travelling to the palace of Brudius, king of the Picts, he travelled over Drumalbin, the *Dorsum Britanniæ* of Adamnan. On the other side, the territory of the Picts was bounded by the Roman province. After Britain was relinquished by the emperor Honorius, they and the Saxons by turns were masters of those countries which lie between the frith of Edinburgh and the river Tweed. We learn from Bede, that the Saxons were masters of Galloway when he finished his Ecclesiastical History. The Picts, however, made a conquest of that country soon after; so that, before the extinction of their monarchy, all the territories bounded on the one side by the Forth and Clyde, and on the other by the Tweed and Solway, fell into their hands.

5 **History.** The history of the Picts, as well as of all the other ancient inhabitants of Britain, is involved in obscurity. The Irish historians give us a long list of Pictish kings, who reigned over Pictavia for the space of 11 or 13 centuries before the Christian era. After them Innes, in his Critical Essay, gives us a list of above fifty, of whom no less than five held the sceptre, each for a whole century. It is probable that these writers had confounded the history of the Picts with that of their ancestors the old Caledonians. In any other view, their accounts of them are highly fabulous; and have been long ago confuted by Dr Macpherson of Slate, an antiquary of much learning and research. The Picts, as has been already

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(A) See *Gough's edition of Camden*, Vol. I. Preface, p. xc. and the *Ancient Universal History*, Vol. XVII. p. 39, &c.

already observed, were probably not known by that name before the 2d or 3d century. Adamnan, abbot of Iona, is the first author that expressly mentions any Pictish king; and the oldest after him is Bede. We are informed by these two writers, that St Columba converted Brudius king of the Picts to the Christian faith. Columba came into Britain in the year of the vulgar era 565. Before that period we have no general record to ascertain so much as the name of any Pictish king. The history of *Drust* or *Drest*, who is said to have reigned over the Picts in the beginning of the fifth century, when St Ninian first preached the gospel to that nation, has all the appearance of fiction (B). His having reigned a hundred years, and his putting an end to a hundred wars, are stories which exceed all the bounds of probability.

Brudius, the contemporary of Columba, is the first Pictish king mentioned by any writer of authority.

What figure his ancestors made, or who were his successors on the throne of Pictavia, cannot be ascertained. Bede informs us, that, during the reign of one of them, the Picts killed Egfred king of Northumberland in battle, and destroyed the greatest part of his army. The same author mentions another of their kings called *Naitan*, for whom he had a particular regard. It was to this *Naitan* that Ceolfrid, abbot of Wiremouth, wrote his famous letter concerning Easter and the Tonsure (C); a letter in which Bede himself is supposed to have had a principal hand. Roger Hoveden and Simon of Durham mention two other Pictish kings *Onnust* and *Kinoth*, the first of whom died in 761, and the latter flourished about the 744, and gave an asylum to Alfred of Northumberland, who was much about that time expelled his kingdom. The accounts given by the Scots historians of several other Pictish kings cannot be depended on; nor are the stories told by the British historians, Geoffroy of Monmouth and the author of the *Eulogium Britanniæ*, worthy of much greater credit.

In the ninth century the Pictish nation was totally subdued by the Scots in the reign of Kenneth Macalpin. Since that time their name has been lost in that of the conquerors, with whom they were incorporated after this conquest; however, they seem to have been treated by the Scottish kings with great lenity, so that for some ages after they commanded a great deal of respect. The prior of Hogulstead, an old English historian, relates, that they made a considerable figure in the army of David the Saint, in his disputes with Stephen king of England. In a battle fought in the year 1136, by the English on one side, and the Scots and Picts on the other, the latter insisted on their hereditary right of leading the van of the Scots army, and were indulged in that request by the king.

The principal seat of the Pictish kings was at Abernethy. Brudius, however, as appears from the accounts given by Adamnan, in his life of Columba, had a palace at Inverness, which was probably near the extremity of his territory in that quarter; for there is no good reason for believing, with Camden, that this king had any property in the Western Isles, or that he had made a gift of Iona to St Columba when he visited him in that place.

6 Manners.

With respect to the manners and customs of the Picts, there is no reason to suppose they were any other than those of the old Caledonians and Scots, of which many particulars are related in the Greek and Roman writers who have occasion to speak of those nations.

Upon the decline of the Roman empire, cohorts of barbarians were raised, and Picts were invited into the service, by Honorius, when peace was everywhere restored, and were named *Honoriaci*. Those under Constantine opened the passes of the Pyrenean mountains, and let the barbarous nations into Spain. From this period we date the civilization of their manners, which happened after they had by themselves, and then with the Scots, ravaged this Roman province.

Picts Wall, in antiquity, a wall begun by the emperor Adrian, on the northern bounds of England, to prevent the incursions of the Picts and Scots. It was first made only of turf strengthened with palisadoes, till the emperor Severus, coming into Britain in person, built it with solid stone. This wall, part of which still remains, began at the entrance of the Solway frith in Cumberland, and running north-east extended to the German ocean. See ADRIAN and SEVERUS.

PICTURE, a piece of painting, or a subject represented in colours, on wood, canvas, paper, or the like. See PAINTING.

PICTURESQUE BEAUTY, says a late writer on that subject, refers to "such beautiful objects as are suited to the pencil." This epithet is chiefly applied to the works of nature, though it will often apply to works of art also. Those objects are most properly denominated picturesque, which are disposed by the hand of nature with a mixture of *varied rudeness*, *simplicity*, and *grandeur*. A plain neat garden, with little variation in its plan, and no striking grandeur in its position, displays too much of art, design, and uniformity, to be called picturesque: "The ideas of *neat* and *smooth* (says Mr Gilpin), instead of being picturesque, in fact disqualify the object in which they reside from any pretensions to picturesque beauty. Nay, farther, we do not scruple to assert, that roughness forms the most essential point of difference between the beautiful and the picturesque; as it seems to be that particular quality which makes

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(B) According to Camden, this conversion happened about the year 630, in the southern Pictish provinces; while the northern, which were separated by fruitful mountains, were converted by Columba.

(C) We are told by some authors that Columba taught the Picts to celebrate Easter always on a Sunday between the 14th and 20th of March, and to observe a different method of tonsure from the Romans, leaving an imperfect appearance of a crown. This occasioned much dispute till Naitan brought his subjects at length to the Roman rule. In that age many of the Picts went on a pilgrimage to Rome, according to the custom of the times; and amongst the rest we find two persons mentioned in the antiquities of St Peter's church. *Asterius* count of the Picts, and *Syra* with his countrymen, performed their vow.

makes objects chiefly pleasing in painting. I use the general term *roughness*; but properly speaking roughness relates only to the surfaces of bodies: when we speak of their delineation, we use the word *ruggedness*. Both ideas, however, equally enter into the picturesque, and both are observable in the smaller as well as in the larger parts of nature; in the outline and bark of a tree, as in the rude summit and craggy sides of a mountain.

Let us then examine our theory by an appeal to experience, and try how far these qualities enter into the idea of picturesque beauty, and how far they mark that difference among objects which is the ground of our inquiry.

"A piece of Palladian architecture may be elegant in the last degree; the proportion of its parts, the propriety of its ornaments, and the symmetry of the whole, may be highly pleasing; but if we introduce it in a picture, it immediately becomes a formal object, and ceases to please. Should we wish to give it picturesque beauty, we must use the mallet instead of the chissel; we must beat down one half of it, deface the other, and throw the mutilated members around in heaps; in short, from a smooth building we must turn it into a rough ruin. No painter who had the choice of the two objects would hesitate a moment.

"Again, why does an elegant piece of garden-ground make no figure on canvas? the shape is pleasing, the combination of the objects harmonious, and the winding of the walk in the very line of beauty. All this is true; but the smoothness of the whole, though right and as it should be in nature, offends in picture. Turn the lawn into a piece of broken ground, plant rugged oaks instead of flowering shrubs, break the edges of the walk, give it the rudeness of a road, mark it with wheel tracks, and scatter around a few stones and brushwood; in a word, instead of making the whole smooth, make it rough, and you make it also picturesque. All the other ingredients of beauty it already possessed." On the whole, picturesque composition consists in uniting in one whole, a variety of parts, and these parts can only be obtained from rough objects.

It is possible, therefore, to find picturesque objects among works of art, and it is possible to make objects so; but the grand scene of picturesque beauty is nature in all its original variety, and in all its irregular grandeur. "We seek it (says our author) among all the ingredients of landscape, trees, rocks, broken grounds, woods, rivers, lakes, plains, valleys, mountains, and distances. These objects in themselves produce infinite variety; no two rocks or trees are exactly the same; they are varied a second time by combination; and almost as much a third time by different lights and shades and other aerial effects. Sometimes we find among them the exhibition of a whole, but oftener we find only beautiful parts."

Sublimity or grandeur alone cannot make an object picturesque: for, as our author remarks, "however grand the mountain or the rock may be, it has no claim to this epithet, unless its form, its colour, or its accompaniments, have some degree of beauty. Nothing can be more sublime than the ocean; but wholly unaccompanied, it has little of the picturesque. When we talk therefore of a sublime object, we always understand that it is also beautiful; and we call it sublime or beautiful only as the ideas of sublimity or simple beauty prevail. But it is not only the form and the composition of the objects of landscape which the picturesque eye examines; it connects them with the atmosphere, and seeks for all those various effects which are produced from that vast and wonderful storehouse of nature. Nor is there in travelling a greater pleasure than when a scene of grandeur bursts unexpectedly upon the eye, accompanied with some accidental circumstance of the atmosphere which harmonizes with it, and gives it double value."

There are few places so barren as to afford no picturesque scene.

————————Believe the muse,
She does not know that inauspicious spot
Where beauty is thus niggard of her store.
Believe the muse, through this terrestrial waste
The seeds of grace are sown, profusely sown,
Even where we least may hope.———

Mr Gilpin mentions the great military road between Newcastle and Carlisle as the most barren tract of country in England; and yet there, he says, there is "always something to amuse the eye. The interchangeable patches of heath and green-sward make an agreeable variety. Often too on these vast tracts of intersecting grounds we see beautiful lights, softening off along the sides of hills; and often we see them adorned with cattle, flocks of sheep, heath-cocks, grouse, plover, and flights of other wild fowl. A group of cattle standing in the shade on the edge of a dark hill, and relieved by a lighter distance beyond them, will often make a complete picture without any other accompaniment. In many other situations also we find them wonderfully pleasing, and capable of making pictures amidst all the deficiencies of landscape. Even a winding road itself is an object of beauty; while the richness of the heath on each side, with the little hillocks and crumbling earth, give many an excellent lesson for a foreground. When we have no opportunity of examining the grand scenery of nature, we have everywhere at least the means of observing with what a multiplicity of parts, and yet with what general simplicity, she covers every surface.

"But if we let the imagination loose, even scenes like these administer great amusement. The imagination can plant hills; can form rivers and lakes in valleys; can build castles and abbeys; and, if it find no other amusement, can dilate itself in vast ideas of space."

Mr Gilpin, after describing such objects as may be called picturesque, proceeds to consider their sources of amusement. We cannot follow our ingenious author through the whole of this consideration, and shall therefore finish our article with a short quotation from the beginning of it. "We might begin (says he) in moral style, and consider the objects of nature in a higher light than merely as amusement. We might observe, that a search after beauty should naturally lead the mind to the great origin of all beauty; to the

———— first good, first perfect, and first fair.

But though in theory this seems a natural climax, we insist the less upon it, as in fact we have scarce ground to hope that every admirer of picturesque beauty is an admirer also of the beauty of virtue ; and that every lover of nature reflects, that

Nature is but a name for an *effect*,
Whose *cause* is God.——

If, however, the admirer of nature can turn his amusements to a higher purpose ; if its great scenes can inspire him with a religious awe, or its tranquil scenes with that complacency of mind which is so nearly allied to benevolence, it is certainly the better. *Apponat lucro.* It is so much into the bargain ; for we dare not promise him more from picturesque travel than a rational and agreeable amusement. Yet even this may be of some use in an age teeming with licentious pleasure ; and may in this light at least be considered as having a moral tendency.

PICUIPINIMA, is the Brasilian name of a species of pigeon, which is so very small as scarcely to exceed the lark in size.

PICUMNUS and PILUMNUS, were two Roman deities, who presided over the auspices required before the celebration of nuptials. Pilumnus was supposed to patronize children, as his name seems in some manner to indicate *quod pellat mala infantiæ*. The manuring of land was first invented by Picumnus, from which reason he is called *Sterquilinius*. Pilumnus is also invoked as the god of bakers and millers, as he is said to have first invented the art of grinding corn.

PICUS, the WOODPECKER, a genus of birds belonging to the order of Picæ. See ORNITHOLOGY *Index*.

PICUS, in fabulous history, a king of Latium, son of Saturn. He married Venilia, also called Canens, by whom he had Faunus. He was tenderly loved by the goddess Pomona, and he returned her affection. As he was one day hunting in the woods, he was met by Circe, who became deeply enamoured of him, and who changed him into a woodpecker, called by the name of *picus* among the Latins. His wife Venilia was so disconsolate when she was informed of his death, that she pined away. Some suppose that Picus was the son of Pilumnus, and that he gave out prophecies to his subjects by means of a favourite woodpecker ; from which circumstance originated the fable of his being metamorphosed into a bird.

PICUS, *John Francis*, prince of Mirandola, nephew of John Pica or Picus, mentioned above, was born about the year 1469. He cultivated learning and the sciences after the example of his uncle ; but he had a principality and dominion to superintend, which involved him in great troubles, and at last cost him his life. He was twice driven from his principality, and twice restored ; and at last, in 1533, was, together with his eldest son Albert, assassinated in his own castle by his nephew Galeoti. He was a great lover of letters ; and such of his works as were then composed were inserted in the Strasburg edition of his uncle's in 1504, and continued in future impressions, besides some others which were never collected.

PIECE, in matters of money, signifies sometimes the same thing with species ; and sometimes, by adding the value of the pieces, it is used to express such as have no other particular name. For the piece of eight, or piastre, see MONEY TABLE.

PIECE, is also a kind of money of account, or rather manner of accounting, used among the negroes on the coast of Angola in Africa. See *Money Table*.

PIECE, in *Heraldry*, denotes an ordinary or charge. The honourable pieces of the shield are the chief, fess, bend, pale, bar, cross, saltier, chevron, and in general all those which may take up one-third of the field, when alone, and in what manner soever it be. See HERALDRY.

PIECES, in the military art, include all sorts of great guns and mortars. Battering pieces are the larger sort of guns used at sieges for making the breaches ; such are the 24-pounder and culverine, the one carrying a 24 and the other an 18 pound ball. Field-pieces are 12 pounds, demiculverines, 6-pounders, sackers, minions, and 3-pounders, which march with the army, and encamp always behind the second line, but in day of battle are in the front. A soldier's firelock is likewise called his *piece*.

PIEDMONT, a country of Italy, having formerly the title of a principality, is bounded on the north by Savoy and Italy ; on the west by France ; on the south by the Mediterranean and the republic of Genoa ; and on the east by the duchies of Montferrat and Milan ; extending about 150 miles from north to south, but much less from east to west. It is called Piedmont, and in Latin *Piedmontium*, from its situation at the foot of the mountains, or Alps, which separate France from Italy. This country is in some parts mountainous, but is everywhere very fruitful. The plains produce fine corn, and Montferrat and the Milanese yield great quantities of Turkey wheat, which commonly serves for bread, and with which the people of the middle rank mix rye ; the pods are used for fuel, and the stalks being thick serve to mend the roads. The hills produce plenty of wine, which, like the Italian wines, is very luscious when new, especially the white. There is also a tartish red wine called *vino brusco*, said to be very wholesome for fat people, and, on the other hand, the sweet wine is recommended as a stomachic. The neighbourhood of Turin is famous for its fine fruits, and many long walks of chesnut and mulberry trees, which produce both pleasure and profit. Marons, or large chesnuts, are a favourite dainty among the common people. These are put into an oven, and, when thoroughly hot, and cooled in red wine, are dried a second time in the oven, and afterwards eaten cold. Truffles grow here in such abundance, that Piedmont has obtained the name of the *truffle country*. Some are black, others white marbled with red. Their price is rated according to their size. Sometimes they are found of 12 or 14 pounds weight ; and many country people earn from 60 to 70 dollars a-year merely by digging for them. The trade in cattle is said to bring into Piedmont no less than three millions of livres per annum. The cultivation of silk is also a profitable article, the Piedmontese silk being, on account of its fineness and strength, esteemed the best in Italy. The Piedmontese gentry breed vast numbers of silk-worms under the care of their tenants, who have the eggs and mulberry leaves delivered to them, and in return they give half the silk to their masters. This principality comprehends eleven small provinces : Piedmont proper, the valleys between France and Italy, the valley of Saluza, the county of Nice, the marquisate of Susa, the duchy of Aost, the Canavese, the lordship of Vetsail,

sail, the county of Ast, and the Langes. It was formerly a part of Lombardy, but now belongs to the king of Sardinia, and lies at the foot of the Alps, which separate France from Italy. It contains many high mountains, among which there are rich and fruitful valleys, as pleasant and populous as any part of Italy. In the mountains are mines of several kinds, and the forests afford a great deal of curious game, among which the *tumor* is an useful animal. "The mules (says Mr Watkins) are very fine in this country; but the inhabitants have other beasts, or rather monsters, which they find very serviceable, though vicious and obstinate. These are produced by a cow and an ass, or mare and bull, and called *jumarres* or *gimerri* (A). I cannot say that I have ever seen any of them, but I am told they are very common."

The Piedmontese are said to be more intelligent than the Savoyards, but less sincere. Some authors represent them as lively, artful, and witty, the inhabitants of the mountain of Aosta excepted, who are farther distinguished by large wens, as even their horses, dogs, and other animals. Mr Baretti, however, in his *Account of Italy*, vol. ii. p. 116. gives the following account of them. "One of the chief qualities (says he), which distinguish the Piedmontese from all other Italians, is their want of cheerfulness. Piedmont never produced a single good poet, as far as the records of the country can go, whereas there is no other province of Italy but what can boast of some poet ancient or modern; and yet the Piedmontese are not deficient in several branches of learning, and some of them have succeeded tolerably well in civil law, physic, and the mathematics. It is likewise observed of this people, that none of them ever attained to any degree of excellence in the polite arts, and it is but lately that they can boast of a painter, Cavaliero Bomente; a statuary, Signor Lodetto; and some architects, Conte Alfieri, Signor Borra, and others, who yet, to say the truth, are far inferior to numberless artists produced by the other provinces of Italy. They have, on the other hand, greatly advanced when considered as soldiers; though their troops have never been very numerous, every body conversant in history knows the brave stand they made for some centuries past against the French, Spaniards, and Germans, whenever they have been invaded by these nations. The skill of the Piedmontese in fortification is likewise very great, and their Benlas and Pintos have shown as much genius as the Vaubans and Cohorns, in rendering impregnable several places which inferior engineers would only have made secure."

Payne's Geog. vol. ii.

The chief trade of this principality consists in hemp and silk. Indeed, so great is their trade in raw silk, that the English alone have purchased to the value of 200,000 lib. in a year. The silk worm thrives so well, that many peasants make above (B) 100 lib. of silk annually; and it is not only abundant, but universally known to be stronger and finer than any in Italy. The land owners divide the profit with their tenants. The Piedmontese workmen, however, are said to want expertness, though they finish their work equally well with those of other natoins. The high duty and land-carriage on mules likewise tend to lessen the value of this trade. They have besides corn, rice, wine, fruits, flax, and cattle.

In the valleys of Lucerne, Peyrouse, and St Martin, which have always belonged to Piedmont, live the celebrated Waldenses or Vaudois, a name which signifies *people of the valleys*. These have rendered themselves famous in history for their dissent from the Romish church long before the time of Luther and Calvin, and for the persecutions they have suffered on that account; but since the year 1730 they have not been openly molested for their religion, but, in order to suppress them by degrees, a popish church has been built in every parish. They are heavily taxed, and labour under great oppressions. The number of people in these valleys scarce at present exceeds 10,000, of which 1000 are Catholics. The chief river of Piedmont is the Po, which flows out of Mount Viso. The river Sesia, the Doria, Baltea, the ancient Druria, the Tenaro, and several others, run into it. The Var, anciently called the Varus, rises in the county of Nice, and after watering it empties itself into the Mediterranean. The language of the Piedmontese is a mixture of French and Italian. In this country are about 50 earldoms, 15 marquisates, a multitude of lordships, and 20 abbeys. Though the country be entirely popish, except some valleys inhabited by the Waldenses, the king reserves to himself the greatest part of the power in church affairs, which in many other places is given up to the pope, and the constitution *unigenitus* is here universally opposed. Towards the end of the 17th century, the French king persuaded the duke of Savoy to drive them out of the country; in consequence of which 200,000 of them retired to Germany, England, and Holland, and yet they are not all extirpated, though, as we have observed, they are obliged to have a Roman Catholic church in every parish.

Turin, formerly the residence of the king of Sardinia, to whom this principality belonged, is the chief city. See TURIN. The number of inhabitants, Mr Watkins says, in Piedmont and Savoy, amount to 2,695,727 souls, of which Turin contains about 77,000. Piedmont was long subject to France, but was restored to the king of Sardinia with the rest of his continental dominions in 1814.

PIENES, a small island of Japan, opposite to the harbour of Saccai, is famed not only for the beauty of its walks, to which crowds of people resort from the city, but for a deity worshipped there, to which vast numbers of persons devote themselves. They go from his temple to the sea side, where they enter into a boat provided

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(A) These equivocal animals, however, if we may so term them, are so generally mentioned by travellers in this part of Europe, that we have no doubt of their existence, or of their being found hardy and serviceable as labourers.

(B) Each pound is valued in Piedmont at 18s. The little village of La Tour, in the valley of Lucerne, makes above 50,000 lb. annually, and the exports every year to the single city of Lyons amount to more than 160,000l. sterling.

provided for the purpose; then, launching into the deep, they throw themselves overboard, loaded with stones, and sink to the bottom. The temple of that deity, which is called Canon, is very large and lofty, and so are many others in the city itself; one in particular, dedicated to the gods of other countries, is thought the finest in the whole empire.

PIEPOUDRE, Court of, the lowest, and at the same time the most expeditious, court of justice known to the law of England. It is called PIEPOUDRE, (*curia pedis pulverizati*), from the dusty feet of the suitors; or, according to Sir Edward Coke, because justice is there done as speedily as dust can fall from the foot: Upon the same principle that justice among the Jews was administered in the gate of the city, that the proceedings might be the more speedy, as well as public. But the etymology given us by a learned modern writer is much more ingenious and satisfactory; it being derived, according to him, from *pied puldreaux*, "a pedlar," in old French, and therefore signifying the court of such petty chapmen as resort to fairs or markets. It is a court of record incident to every fair and market; of which the steward of him who owns or has the toll of the market is the judge. It was instituted to administer justice for all commercial injuries done in that very fair or market, and not in any preceding one. So that the injury must be done, complained of, heard, and determined, within the compass of one and the same day, unless the fair continues longer. The court hath cognizance of all matters of contract that can possibly arise within the precinct of that fair or market; and the plaintiff must make oath that the cause of an action arose there. From this court a writ of error lies, in the nature of an appeal, to the courts at Westminster. The reason of its institution seems to have been, to do justice expeditiously among the variety of persons that resort from distant places to a fair or market; since it is probable, that no other inferior court might be able to serve its process, or execute its judgments, on both or perhaps either of the parties; and therefore, unless this court had been erected, the complaint must necessarily have resorted even in the first instance to some superior judicature.

PIER, in building, denotes a mass of stone, &c. opposed by way of fortress to the force of the sea, or a great river, for the security of ships that lie at harbour in any haven.

Piers of a Bridge. See Bridge.

PIERCEA. See Rivinia.

PIERIA, in *Ancient Geography*, a district of Macedonia, contained between the mouths of the rivers Ludias and Peneus; extended by Strabo beyond the Ludias, to the river Axios on the north, and on the south no farther than the Aliacmon, along the west side of the Sinus Thermaicus.—Another *Pieria* of Syria, the north part of Seleucia, or the *Antiochena*, situated on the Sinus Issicus, and lying next Cilicia to the north-west.

PIERIDES, in fabulous history, the daughters of Pierus a Macedonian prince, presuming to dispute with the muses for the prize of poetry, were turned into magpies. The name of *Pierides* was also given to the muses, from Mount Pieris in Thessaly, which was consecrated to them; or, according to others, from Pieris, a Thessalian poet, who was the first who sacrificed to them. See Pieris.

PIERINO del Vaga, an eminent Italian painter, born of poor parents in Tuscany, about the year 1500. He was placed apprentice with a grocer in Florence, and got some instructions from the painters to whom he was sent with colours and pencils; but a painter named *Vaga* taking him to Rome, he was called *Del Vaga*, from living with him, his real name being *Buanacorsi*. He studied anatomy with the sciences necessary for his profession; and had somewhat of every thing that was good in his compositions. After Raphael's death, he joined with Julio Romano and Francisco Penni to finish the works in the Vatican which were left imperfect by their common master; and to confirm their friendship married Penni's sister. He gained the highest reputation by his performances in the palace of Prince Doria at Genoa: but the multiplicity of his business, and the vivacity of his imagination, drained his spirits in the flower of his age; for he died in the year 1547. Of all Raphael's disciples, Pierino kept the character of his master longest, i. e. his exterior character and manner of designing; for he fell very short of the fineness of Raphael's thinking. He had a particular genius for the decoration of places according to their customs. His invention in that kind of painting was full of ingenuity; grace and order are everywhere to be met with, and his dispositions, which are ordinary in his pictures, are wonderful in his ornaments: some of these he has made little, and some great, and placed them both with so much art, that they set off one another by comparison and contrast. His figures are disposed and designed according to Raphael's gusto; and if Raphael gave him at first some slight sketches of ornaments, as he did to Giovanni d'Udine, he executed them to admiration. The tapestries of the seven planets, in seven pieces, which Pierino designed for Diana de Poitiers, and which were, when De Piles wrote, with Monsieur the first president at Paris, show sufficiently what he was, and that the above character does not exceed the truth.

PIERIS, in *Ancient Geography*, a mountain which is thought to have given name to Pieria of Macedonia; taking its name from Pierus a poet, who was the first that sacrificed to the Muses, thence called *Pierides*, if credit may be given to an ancient scholiast on Juvenal.

PIERRE d'automne is a French name, translated from the Chinese, of a medicinal stone, celebrated in the east for curing all disorders of the lungs. Many imagine it had its name of the autumn-stone from its being only to be made at that season of the year; but it may certainly be made equally at all times. The Chinese chemists refer the various parts of the body to the several seasons of the year, and thus they refer the lungs to autumn. This is evident in their writings, and thus the stone for diseases of the lungs came to be called *autumn-stone*. It is prepared as follows: They put 30 pints of the urine of a strong and healthy young man into a large iron pot, and set it over a gentle fire. When it begins to boil, they add to it, drop by drop, about a large tea-cup-full of rape oil. They then leave it on the fire till the whole is evaporated to a thick substance like black mud. It is then taken out of the pot, and laid on a flat iron to dry, so that it may be powdered very fine. The powder is moistened with fresh oil, and the mass is put into a double crucible, surrounded with coals, where it stands till it be thoroughly dried again. This is again powdered, and put into a china vessel, which being covered with a silk cloth and a double paper, they pour on it boiling water, which makes its way, drop by drop, through those coverings, till so much is got in as is sufficient to reduce it to a paste. This paste is well mixed together in the vessel it is kept in, and this is put into a vessel of water, and the whole set over the fire. The matter thus becomes again dried in *balneo mariæ*, and is then finished. *Observ. sur les Cout. de l'Asie*, p. 258.

PIERRE, *St*, is a large river in North America, scarcely inferior to the Rhine or the Danube, and navigable almost to its source. Together with many other large streams, it falls into the river Mississippi.

PIERRE, *St*, or *St Peter's*, the capital of Martinico, was built in 1665, in order to overawe the mutineers of the island who rebelled against its proprietors, the second West India Company, who were at the same time the proprietors of all the French Antilles. It is situated on the western side of the island. The town extends along the shore, and a battery that commands the road is erected on the west side, which is washed by the river Royolan, or St Peter. The town is divided into three wards; the middle, which is properly St Peter's, begins at the fort, and runs westward to the battery of St Nicholas. Under the walls of the second ward ships at anchor ride more securely than under the fort, on which account this ward is called the *Anchorage*. The third ward, called the *Gallery*, extends along the sea side from Fort St Peter to the Jesuits River, and is the most populous part of the city. The houses of St Peter's ward are neat, commodious, and elegant, particularly those of the governor of the island, the intendant, and the other officers. The parish church of St Peter is a magnificent stone building which belonged to the Jesuits, with a noble front of the Doric order. The church of the Anchorage, which belongs to the Jacobine friars, is likewise of stone. It is a place of considerable trade, and is built with tolerable regularity. The houses are mostly constructed of a gray pumice-stone or lava, which is found on the strand; and the high-street is, according to Dr Isert, above an English mile in length. It is supposed to contain about 2000 houses, and 30,000 inhabitants, including negroes. St Pierre, with the whole of the flourishing island of Martinico, was taken from the French in the month of March 1794, by the British troops: 125 vessels loaded with the produce of the island, and of great value, were captured, 71 of which were in the harbour of St Pierre.

PIETISTS, a religious sect, sprung up among the Protestants of Germany, seeming to be a kind of mean between the Quakers of England and the Quietists of the Romish church. They despise all sorts of ecclesiastical polity, all school theology, and all forms and ceremonies, and gave themselves up to contemplation and the mystic theology. Many gross errors are charged on the Pietists, in a book entitled *Manipulus Observationum Antipietisticarum*; but they have much of the air of polemical exaggeration, and are certainly not at all just. Indeed there are Pietists of various kinds: Some running into gross illusions, and carrying their errors to the overturning of a great part of the Christian doctrine, while others are only visionaries; and others are very honest and good, though perhaps misguided, people. They have been disgusted with the coldness and formality of other churches, and have thence become charmed with the fervent piety of the Pietists, and attached to their party, without giving into the grossest of their errors. See *Mosheim's Eccl. History*, vol. iv. p. 454.

PIETISTS, otherwise called the *Brethren and Sisters of the Pious and Christian Schools*, a society formed in the year 1678 by Nicholas Barre, and obliged by their engagements to devote themselves to the education of poor children of both sexes.

PIETOLA, anciently called *Andes*, is a place within two Italian miles of Mantua, famous for being the birthplace of Virgil.

PIETY, is a virtue which denotes veneration for the Deity, and love and tenderness to our friends. This distinguished virtue, like many others, received among the Romans divine honours, and was made one of their gods. Acilius Glabrio first erected a temple to this divinity, which he did upon the spot on which a woman had fed with her own milk her aged father, who had been imprisoned by order of the senate, and deprived of all aliments. The story is well known, and is given at length in authors which are in the hands of every schoolboy. See *Cicero de div.* I. and *Valerius Maximus*, v. c. 4. and our article *FILIAL Piety*.

If piety was thus practised and thus honoured in Heathen antiquity, it surely ought not to be less so, among Christians, to whom its nature is better defined, and to the practice of which they have motives of greater cogency. A learned and elegant writer has said that the want of piety arises from the want of sensibility; and his observations and arguments are so just and so well expressed, that we cannot do better than transcribe them.

"It appears to me (says Dr Knox), that the mind of man, when it is free from natural defects and acquired corruption, feels no less a tendency to the indulgence of devotion than to virtuous love, or to any other of the more refined and elevated affections. But debauchery and excess contribute greatly to destroy all the susceptible delicacy with which nature usually furnishes the heart; and, in the general extinction of our better qualities, it is no wonder that so pure a sentiment as that of piety should be one of the first to expire.

"It is certain that the understanding may be improved in a knowledge of the world, and in the arts of succeeding in it, while the heart, or whatever constitutes the seat of the moral and sentimental feelings, is gradually receding from its proper and original perfection. Indeed experience seems to evince, that it is hardly possible to arrive at the character of a complete man of the world, without losing many of the most valuable sentiments of uncorrupted nature. A complete man of the world is an artificial being; he has discarded many of the native and laudable tendencies of his mind, and adopted a new system of objects and propensities of his own creation. These are commonly gross, coarse, sordid, selfish, and sensual. All, or either of these attributes, tend directly to blunt the sense of every thing liberal, enlarged, disinterested; of every thing which participates more of an intellectual than of a sensual nature. When the heart is tied down to the earth by lust and avarice, it is not extraordinary that the eye should be seldom lifted up to heaven. To the man who spends his Sunday (because he thinks the day fit for little else) in the counting-house, in travelling, in the tavern, or in the brothel, those who go to church appear as fools, and the business they go upon as nonsense. He is callous to the feelings of devotion; but he is tremblingly alive to all that gratifies his senses or promotes his interest.

"It has been remarked of those writers who have attacked Christianity, and represented all religions merely as diversified modes of superstition, that they were indeed, for the most part, men of a metaphysical and a disputatious turn of mind, but usually little distinguished for benignity and generosity. There was, amidst all their pretensions to logical sagacity, a cloudiness of ideas, and a coldness of heart, which rendered them very unfit judges on a question in which the heart is chiefly interested; in which the language of nature is more expressive and convincing, than all the dreary subtleties of the dismal metaphysicians. Even the reasoning faculty, on which we so greatly value ourselves, may be perverted by excessive refinement; and there is an abstruse, but vain and foolish philosophy, which philosophizes us out of the noblest parts of our noble nature. One of those parts of us is our instinctive sense of religion, of which not one of those brutes which the philosophers most admire, and to whose rank they wish to reduce us, is found in the slightest degree to participate.

"Such philosophers may be called, in a double sense, the enemies of mankind. They not only endeavour to entice man from his duty, but to rob him of a most exalted and natural pleasure. Such, surely, is the pleasure of devotion. For when the soul rises above this little orb, and pours its adoration at the throne of celestial majesty, the holy fervour which it feels is itself a rapturous delight. Neither is this a declamatory representation, but a truth felt and acknowledged by all the sons of men; except those who have been defective in sensibility, or who hoped to gratify the pride or the malignity of their hearts by singular and pernicious speculation.

"Indeed all disputatious, controversial, and metaphysical writings on the subject of religion, are unfavourable to genuine piety. We do not find that the most renowned polemics in the church militant were at all more attentive than others to the common offices of religion, or that they were actuated by any peculiar degree of devotion. The truth is, their religion centered in their heads, whereas its natural region is the heart. The heart! confined, alas! in colleges or libraries, unacquainted with all the tender charities of husband, father, brother, friend; some of them have almost forgotten that they possess a heart. It has long ceased to beat with the pulsations of love and sympathy, and has been engrossed by pride on conquering an adversary in the syllogistic combat, or by impotent anger on a defeat. With such habits, and so defective a system of feelings, can we expect that a doctor of the Sorbonne, or the disputing professor of divinity, should ever feel the pure flame of piety that glowed in the bosoms of Mrs Rowe, Mrs Talbot, or Mr Nelson?

"It is however certain, that a devotional taste and habit are very desirable in themselves, exclusive of their effects in meliorating the morals and disposition, and promoting present and future felicity. They add dignity, pleasure, and security to any age: but to old age they are the most becoming grace, the most substantial support, and the sweetest comfort. In order to preserve them, it will be necessary to preserve our sensibility; and nothing will contribute so much to this purpose as a life of temperance, innocence, and simplicity."

Of piety, as it denotes love and tenderness to our friends, there have been many distinguished instances both in ancient and modern times. See *FILIAL Piety*, *FRATERNAL* and *PARENTAL Affection*, &c.

The following example of filial piety in China, taken from P. Du Halde's description of that country, will not we trust be disagreeable to our readers. "In the commencement of the dynasty of the Tang, Lou-tao-tsong, who was disaffected to the government, being accused of a fault, which touched his life, obtained leave from those who had him in custody, to perform the duties of the Tao to one of his diseased friends. He managed matters so well, that giving his keepers the slip, he fled to the house of Lou Nan-kin, with whom he had a friendship, and there hid himself. Lou Nan-kin, notwithstanding the strict search that was made, and the severity of the court against those who conceal prisoners that have escaped, would not betray his friend. However, the thing coming to be discovered, Lou Nan-kin was imprisoned; and they were just on the point of proceeding against him, when his younger brother presenting himself before the judge, *It is I, Sir*, said he, *who have hidden the prisoner; it is I who ought to die, and not my elder brother*. The eldest maintained on the contrary, that his younger brother accused himself wrongfully, and was not at all culpable. The judge, who was a person of great sagacity, sifted both parties so effectually, that he not only discovered that the younger brother was innocent, but even made him confess it himself: *It is true, Sir*, said the younger all in tears, *I have accused myself falsely; but I have very strong reasons for so doing. My mother has been dead for some time, and her corpse is not yet buried; I have a sister also who is marriageable, but is not yet disposed of: these things which my brother is capable of managing, I am not, and therefore desire to die in his stead. Vouchsafe to admit my testimony*. The commissioner gave an account of the whole affair to the court, and the emperor at his solicitation pardoned the criminal."

PIG, see SUS, } MAMMALIA *Index*.
Guinea-PIG, see MUS, }

PIG of lead, the eighth part of a fother, amounting to 250 pounds weight.

PIGANIOL DE LA FORCE, JOHN AYMAR DE, a native of Auvergne, of a noble family, applied himself with ardour to the study of geography and of the history of France. With the view of improving himself in this study, he travelled into different provinces; and, in the course of his travels, made some important observations on the natural history, the commerce, the civil and ecclesiastical government of each province. These observations were of great use to him in compiling the works he has left behind him, of which the chief are, 1. An Historical and Geographical Description of France; the largest edition of which is that of 1753, in 15 vols. 12mo. It is the best work which has hitherto appeared upon that subject, though it contains a great number of inaccuracies and even errors. 2. A Description of Paris, in 10 vols. 12mo; a work equally entertaining and instructive, and much more complete than the description given by Germain Brice: besides, it is written with an elegant simplicity. He published an abridgement of it in 2 vols. 12mo. 3. A Description of the Castle and Park of Versailles, Marly, &c. in 2 vols. 12mo: it is very amusing, and pretty well executed. Piganiol had also a concern with Abbé Nadal in the journal of Trevoux. He died at Paris in February 1753, at the age of 80 years. This learned man was as much to be respected for his manners as for his talents. To a profound and varied knowledge he united great probity and honour, and all the politeness of a courtier.

PIGEON, see Columba, Ornithology *Index*.

Pigeon-House is a house erected full of holes within, for the keeping, breeding, &c. of pigeons, otherwise called a *dove-cot*.

Any lord of manor may build a pigeon-house on his land, but a tenant cannot do it without the lord's licence. When persons shoot at or kill pigeons within a certain distance of the pigeon-house, they are liable to pay a forfeiture.

In order to erect a pigeon-house to advantage, it will be necessary, in the first place, to pitch upon a convenient situation; of which none is more proper than the middle of a spacious court-yard, because pigeons are naturally of a timorous disposition, and the least noise they hear frightens them. With regard to the size of the pigeon-house, it must depend entirely upon the number of birds intended to be kept; but it is better to have it too large than too little; and as to its form, the round should be preferred to the square ones; because rats cannot so easily come at them in the former as in the latter. It is also much more commodious; because you may, by means of a ladder turning upon an axis, easily visit all the nests in the house, without the least difficulty; which cannot so easily be done in a square house. In order to hinder rats from climbing up the outside of the pigeon-house, the wall should be covered with tin plates to a certain height, about a foot and a half will be sufficient; but they should project out three or four inches at the top, to prevent their clambering any higher.

The pigeon-house should be placed at no great distance from water, that the pigeons may carry it to their young ones; and their carrying it in their bills will warm it, and render it more wholesome in cold weather. The boards that cover the pigeon-house should be well joined together, so that no rain may penetrate through it: and the whole building should be covered with hard plaster, and white-washed within and without, white being the most pleasing colour to pigeons. There must be no window, or other opening in the pigeon-house to the eastward; these should always face the south, for pigeons are very fond of the sun, especially in winter.

The nests or covers in a pigeon-house should consist of square holes made in the walls, of a size sufficient to admit the cock and hen to stand in them. The first range of these nests should not be less than four feet from the ground, that the wall underneath being smooth, the rats may not be able to reach them. These nests should be placed in quincunx order, and not directly over one another. Nor must they be continued any higher than within three feet of the top of the wall: and the upper row should be covered with a board projecting a considerable distance from the wall, for fear the rats should find means to climb the outside of the house.

M. Duhamel thinks that pigeons neither feed upon the green corn, nor have bills strong enough to search for its seeds in the earth; but only pick up the grains that are not covered, which would infallibly become the prey of other animals, or be dried up by the sun. "From the time of the sprouting of the corn, says he, pigeons live chiefly upon the seeds of wild uncultivated plants, and therefore lessen considerably the quantity of weeds that would otherwise spring up; as will appear from a just estimate of the quantity of grain necessary to feed all the pigeons of a well-stocked dove-house." But Mr Worlidge and Mr Lisle allege facts in support of the contrary opinion. The latter relates, that a farmer in his neighbourhood assured him he had known an acre sowed with pease, and rain coming on so that they could not be harrowed in, every pea was fetched away in half a day's time by pigeons: and the former says, "It is to be observed, that where the flight of pigeons falls, there they fill themselves and away, and return again where they first rose, and so proceed over a whole piece of ground, if they like it. Although you cannot perceive any grain above the ground, they know how to find it. I have seen them lie so much upon a piece of about two or three acres sown with pease, that they devoured at least three parts in four of the seed, which, I am sure, could not be all above the surface of the ground. That their smelling is their principal director, I have observed; having sown a small plat of pease in my garden, near a pigeon-house, and covered them so well that not a pea appeared above ground. In a few days, a parcel of pigeons were hard at work in discovering this hidden treasure; and in a few days more I had not above two or three peas left out of about two quarts that were planted; for what they could not find before, they found when the buds appeared, notwithstanding they were hoed in, and well covered. Their smelling alone directed them, as I supposed, because they followed the ranges exactly. The injury they do at harvest on the pease, vetches, &c. is such that we may rank them among the greatest enemies the poor husbandman meets withal; and the greater, because he may not erect a pigeon-house, whereby to have a share of his own spoils; none but the rich being allowed this privilege, and so severe a law being also made to protect these winged thieves, that a man cannot encounter them, even in defence of his own property. You have therefore no remedy against them, but to affright them away by noises or such like. You may, indeed, shoot at them; but you must not kill them; or you may, if you can, take them in a net, cut off their tails, and let them go; by which means you will impound them: for when you are in their houses, they cannot bolt or fly out of the tops of them, but by the strength of their tails; after the thus weakening of which, they remain prisoners at home."

Mr Worlidge's impounding the pigeons reminds us of a humorous story of a gentleman, who, upon a neighbouring farmer's complaining to him, that his pigeons were a great nuisance to his land, and did sad mischief to his corn, replied jokingly, Pound them, if you catch them trespassing. The farmer, improving the hint, steeped a parcel of pease in an infusion of *coculus indicus*, or some other intoxicating drug, and strewed them upon his grounds. The pigeons swallowed them, and soon remained motionless on the field: upon which the farmer threw a net over them, inclosed them in it, and carried them to an empty barn, from whence he sent the gentleman word that he had followed his directions with regard to the pounding of his pigeons, and desired him to come and release them.

Carrier-Pigeon. See *Carrier-Pigeon* and Columba, Ornithology *Index*.

Pigeon, *Peter Charles Francis*, curate of St Peter du Regard, in the diocese of Bayeux, was one of the priests lately belonging to the king's house at Winchester. He was born in Lower Normandy, of honest and virtuous parents, and of a decent fortune. His inclinations early led him to embrace the ecclesiastical state, from which neither the solicitations of his friends, nor the prospect of a more ample fortune on the death of his elder brother, could withdraw him. Several of his schoolfellows and masters, who are now resident in the king's house at Winchester, bear the most ample testimony to his assiduity, regularity, piety, and the sweetness of his disposition, during the whole course of his education. The sweetness of temper, in particular, was so remarkable, and so clearly depicted on his countenance, as to have gained him the esteem and affection of such of the inhabitants of Winchester as by any means had become acquainted with him. He was seven years employed in quality of vicar, or, as we should call it *curate*, of a large parish in the diocese of Seez, where his virtues and talents had ample scope for exertion. His practice was to rise at five o'clock every morning, and to spend the whole time till noon (the usual time of dining for persons in his station) in prayer and study. The rest of the day, till evening, he devoted to visiting the sick, and other exterior duties of his function. In 1789, the year of the French revolution, M. Pigeon was promoted to a curacy, or rather a rectory, in the diocese of Bayeux, called the *parish of St Peter du Regard*, near the town of Condè sur Noereau. It was easy for him to gain the good-will and the protection of his parishioners; but a Jacobin club in the above-mentioned town seemed to have no other subject to deliberate upon than the various ways of harassing and persecuting M. Pigeon and certain other priests in the neighbourhood, who had from motives of conscience refused the famous civic oath. It would be tedious to relate the many cruelties which were at different times exercised upon him, and the imminent danger of losing his life to which he was exposed, by the blows that were inflicted on him, by his being thrown into water, and being obliged to wander in woods and other solitary places, without any food or place to lay his head, in order to avoid his persecutors. We may form some judgment of the spirit of his persecutors from the following circumstance. Being disappointed on a particular occasion in the search they were making after M. Pigeon, with the view of amusing themselves with his sufferings, they made themselves amends by seizing his mother, a respectable lady of 74 years of age, and his two sisters, whom they placed upon asses with their faces turned backwards, obliging them in derision to hold the tails of these animals. Thus they were conducted in pain and ignominy throughout the whole town of Condè, for no other alleged crime except being the nearest relations of M. Pigeon. At length the decree for transporting all the ecclesiastics arrived; and this gentleman, with several others, after having been stripped of all their money, was shipped from Port Bessin, and landed at Portsmouth, where he was shortly after received into the establishment at Foxton, and, upon that being dissolved in order to make room for prisoners of war, into the king's house at Winchester. Being of a studious turn, he was accustomed, as many of his brethren also were, to betake himself to the neighbouring lanes and thickets for the sake of greater solitude. With this view having, about ten o'clock in the morning, Aug. 28. 1793, retired to a certain little valley, on the north-east side of a place called *Oram's Arbour*, the same place where the county elections for Hampshire are held, he was there found, between three and four o'clock in the afternoon, murdered, with the upper part of his skull absolutely broken from the lower part, and a large hedge-stake, covered with blood, lying by him, as were the papers on which he had been transcribing a manuscript sermon with the hearing of which he had been much edified, and the sermon itself which he was copying, together with his pen, imbrued in blood. His watch was carried away, though part of the chain, which had been by some means broken, was left behind. He was writing the word *paradise*, the last letters of which remained unwritten when the fatal blow was given him, which appears evidently to have been discharged upon him from a gap in a hedge which was immediately behind him. At first the suspicion of this cruel murder fell upon the French democrats, who, to the number of 200, are prisoners of war, at the neighbouring town of Alresford, as one of that number, who had broke his parole, had, about three weeks before, being taken up at Winchester, and both there and at Alresford had repeatedly threatened to murder his uncle, a priest, whom he understood to be then at Winchester, not without fervent wishes of having it in his power to murder the whole establishment, consisting of more than 600 persons. However, as no French prisoner was seen that day in the neighbourhood of Winchester, as none of them were known to have left Alresford, it is evidently reasonable to acquiesce in the verdict of the coroner; namely, that the murder was committed by a person or persons unknown. The most noble marquis of Buckingham, whose munificence and kindness to those conscientious exiles, the emigrant French clergy, can only be conceived by those who have been witnesses of the same, with the truly respectable corps of the Buckinghamshire militia then quartered at Winchester, joined in paying the last mark of respect to the unfortunate deceased, by attending his funeral, which was performed at the Roman Catholic burying-ground, called *St James's*, near the said city, on Saturday, Aug. 29. He was just 38 years of age when he was murdered.

PIGMENTS, preparations used by painters, dyers, &c. to impart colours to bodies, or to imitate particular colours. See *Colour-Making*, and Dyeing.

PIGNEROL is a town of Italy in the province of Piedmont, in E. Long. 7. 15. N. Lat. 44. 45. situated on the river Chizon, 10 miles south-west of Turin, at the foot of the Alps, and the confines of Dauphiny. The town is small, but populous, and extremely well fortified by the king of Sardinia, since the treaty of Utrecht. It is defended by a citadel, on the top of the mountain near which is the castle of Perouse, which was built at the entrance of the valley of that name.

PIGNUT, or *Earthnut*. See Bunium, Botany *Index*.

PIGUS, in *Ichthyology*, is the name of a species of leather-mouthed fish, very much resembling the nature of the common carp; being of the same shape and size, and its eyes, fins, and fleshy palate, exactly the same; from the gills to the tail there is a crooked dotted line; the back and sides are bluish, and the belly reddish. It is covered with large scales; from the middle of each of which there rises a fine pellucid prickle, which is very sharp. It is an excellent fish for the table, being perhaps preferable to the carp; and it is in season in the months of March and April. It is caught in lakes in some parts of Italy, and is mentioned by Pliny, though without a name. Artedi says it is a species of cyprinus, and he calls it the *cyprinus*, called *piclo* and *pigus*.

PI-HAHIROTH, (Moses); understood to be a mouth or narrow pass between two mountains, called *Chiroth* or *Eiroth*, and lying not far from the bottom of the western coast of the Arabian gulf; before which mouth the children of Israel encamped, just before their entering the Red sea, (Wells).

PIISKER, in *Ichthyology*, is a fish of the mustela kind, commonly called the *fossil mustela*, or *fossil-fish*. This fish is generally found as long as an ordinary man's hand is broad, and as thick as the finger; but it sometimes grows much longer: the back is of gray, with a number of spots and transverse streaks, partly black and partly blue; the belly is yellow, and spotted with red, white, and black; the white are the larger, the others look as if they were made with the point of a needle; and there is on each of the sides a longitudinal black and white line. There are some fleshy excrescences at the mouth, which are expanded in swimming; and when out of the water, they are contracted. These fishes run into caverns of the earth, in the sides of rivers, in marshy places, and penetrate a great way, and are often dug up at a distance from waters. Often, when the waters of brooks and rivers swell beyond their banks, and again cover them, they make their way out of the earth into the water; and when it deserts them, they are often left in vast numbers upon the ground, and become a prey to swine. It is thought to be much of the same kind with the fisgum fish; and is indeed possible that that the pæcilia of Schonefeldt is the same.

PIKE. See Esox, Ichthyology *Index*.

The pike never swims in shoals as most other fish do, but always lies alone; and is so bold and ravenous, that he will seize upon almost any thing less than himself. Of the ravenous nature of this fish we shall give the following instances. At Rycott in Oxfordshire, in the year 1749, in a moat surrounding the earl of Abingdon's seat, there was a jack or pike of such a monstrous size, that it had destroyed young swans feathers and all. An old cobb swan having hatched five young, one after another was lost till four were gone. At length an under gardener saw the fish seize the fifth. The old one fought him with her beak, and, with the assistance of the gardener, released it, although he had got it under water. In the year 1765 a large pike was caught in the river Ouze, which weighed upwards of 28 pounds, and was sold for a guinea. On gutting the fish, a watch with a black ribbon and two steel seals were found in its stomach, which, by the maker's name, &c. was found to belong to a person who had been drowned about six weeks before. This fish breeds but once in a year, which is in March. It is found in almost all fresh waters; but it is very different in goodness, according to the nature of the places where it lives. The finest pike are those which feed in clear rivers; those in ponds and meres are inferior, and the worst of all are those of the fen ditches. They are very plentiful in these last places, where the water is foul and coloured, and their food, such as frogs and the like, very plentiful, but very coarse; so that they grow large, but are yellowish and high bellied, and differ greatly from those which live in the clearer waters.

The fishermen have two principal ways of catching the pike; by the ledger, and by the walking-bait.

The ledger-bait is fixed in one certain place, and may continue while the angler is absent. This must be a live bait, a fish or frog: and among fish, the dace, roach, and gudgeon, are the best; of frogs, the only caution is to choose the largest and yellowest that can be met with. If the bait be a fish, the hook is to be stuck through the upper lip, and the line must be 14 yards at least in length; the other end of this is to be tied to a bough of a tree, or to a stick driven into the ground near the pike's haunt, and all the line wound round a forked stick, except about half a yard. The bait will by this means keep playing so much under water, and the pike will soon lay hold of it.

If the bait be a frog, then the arming wire of the hook should be put in at the mouth, and out at the side; and with a needle and some strong silk, the hinder leg of one side is to be fastened by one stitch to the wire-arming of the hook. The pike will soon seize this, and must have line enough to give him leave to get to his haunt and poach the bait.

The trolling for pike is a pleasant method also of taking them: in this a dead bait serves, and none is so proper as a gudgeon.

This is to be pulled about in the water till the pike seizes it; and then it is to have line enough, and time to swallow it: the hook is small for this sport, and has a smooth piece of lead fixed at its end to sink the bait; and the line is very long, and runs through a ring at the end of the rod, which must not be too slender at top.

The art of feeding pike, so as to make them very fat, is the giving them eels; and without this it is not to be done under a very long time; otherwise perch, while small, and their prickly fins tender, are the best food for them. Bream put into a pike-pond are a very proper food; they will breed freely, and their young ones make excellent food for the pike, who will take care that they shall not increase over much. The numerous shoals of roaches and ruds, which are continually changing place, and often in floods get into the pike's quarters, are food for them for a long time.

Pike, when used to be fed by hand, will come up to the very shore, and take the food that is given them out of the fingers of the feeder. It is wonderful to see with what courage they will do this, after a while practising; and it is a very diverting sight when there are several of them nearly of the same size, to see what striving and fighting there will be for the best bits when they are thrown in. The most convenient place is near the mouth of the pond, and where there is about half a yard depth of water; for, by that means, the offal of the feedings will all lie in one place, and the deep water will

will serve for a place to retire into and rest in, and will be always clean and in order.

Carp may be fed in the same manner as pike; and though by nature a fish as remarkably shy and timorous as the pike is bold and fearless, yet by custom they will come to take their food out of the person's hand; and will, like the pike quarrel among one another for the nicest bits.

Pike, in *War*, an offensive weapon, consisting of a wooden shaft, 12 or 14 feet long, with a flat steel head, pointed, called the *spear*. This weapon was long in use among the infantry; but now the bayonet, which is fixed on the muzzle of the firelock, is substituted in its stead. It is still used by some of the officers of infantry, under the name of *sponton*. The Macedonian phalanx was a battalion of pikemen. See Phalanx.

PILA marina, or the *sea-ball*, in *Natural History*, is the name of a substance very common on the shores of the Mediterranean, and elsewhere. It is generally found in the form of a ball about the size of the balls of horse dung, and composed of a variety of fibrillæ irregularly complicated. Various conjectures have been given of its origin by different authors. John Bauhine tells us, that it consists of small hairy fibres and straws, such as are found about the sea plant called *alga vitriariorum*; but he does not ascertain what plant it owes its origin to. Imperatus imagined it consisted of the exuviæ both of vegetable and animal bodies. Mercatus is doubtful whether it be a congeries of the fibrillæ of plants, wound up into a ball by the motion of the sea water, or whether it be not the workmanship of some sort of beetle living about the sea shore, and analogous to our common dung beetle's ball, which it elaborates from dung for the reception of its progeny. Schreckius says it is composed of the filaments of some plant of the reed kind: and Welchius supposes it is composed of the pappous part of the flowers of the reed. Maurice Hoffman thinks it the excrement of the hippopotamus; and others think it that of the phoca or sea calf. Klein, who had thoroughly and minutely examined the bodies themselves, and also what authors had conjectured concerning them, thinks that they are wholly owing to, and entirely composed of, the capillaments which the leaves, growing to the woody stalk of the *alga vitriariorum*, have when they wither and decay. These leaves, in their natural state, are as thick as a wheat straw, and they are placed so thick about the tops and extremities of the stalks, that they enfold, embrace, and lie over one another; and from the middle of these clusters of leaves, and indeed from the woody substance of the plant itself, there arise several other very long, flat, smooth, and brittle leaves. These are usually four from each tuft of the other leaves; and they have ever a common vagina, which is membranaceous and very thin. This is the style of the plant, and the *pila marina* appears to be a cluster of the fibres of the leaves of this plant, which cover the whole stalk, divided into their constituent fibres; and by the motion of the waves first broken and worn into short shreds, and afterwards wound up together into a roundish or longish ball.

Pila, was a ball made in a different manner according to the different games in which it was to be used. Playing at ball was very common amongst the Romans of the first distinction, and was looked upon as a manly exercise, which contributed both to amusement and health. The pila was of four sorts: 1st, *Follis* or *balloon*; 2d, *Pila Trigonalis*; 3d, *Pila Paganica*; 4th, *Harpastum*. All these come under the general name of pila. For the manner of playing with each of them, see the articles Follis, Trigonalis.

PILASTER, in *Architecture*. See there, N° 50, &c.

PILATE, or **Pontius Pilate**, was governor of Judea when our Lord was crucified. Of his family or country we know but little, though it is believed that he was of Rome, or at least of Italy. He was sent to govern Judea in the room of Gratus, in the year 26 or 27 of the vulgar era, and governed this province for ten years, from the 12th or 13th year of Tiberius to the 22d or 23d. He is represented both by Philo and Josephus as a man of an impetuous and obstinate temper, and as a judge who used to sell justice, and to pronounce any sentence that was desired, provided he was paid for it. The same authors make mention of his rapines, his injuries, his murders, the torments that he inflicted upon the innocent, and the persons he put to death without any form of process. Philo, in particular, describes him as a man that exercised an excessive cruelty during the whole time of his government, who disturbed the repose of Judea, and gave occasion to the troubles and revolt that followed after. St Luke (xiii. 1, 2, &c.) acquaints us, that Pilate had mingled the blood of the Galileans with their sacrifices; and that the matter having been related to Jesus Christ, he said, "Think you that these Galileans were greater sinners than other Galileans, because they suffered this calamity. I tell you nay; and if you do not repent, you shall all perish in like manner." It is unknown upon what occasion Pilate caused these Galileans to be slain in the temple while they were sacrificing; for this is the meaning of that expression of mingling their blood with their sacrifices. Some think they were disciples of Judas the Gaulonite, who taught that the Jews ought not to pay tribute to foreign princes; and that Pilate had put some of them to death even in the temple; but there is no proof of this fact. Others think that these Galileans were Samaritans, whom Pilate cut to pieces in the village of Tirataba *, as they were preparing to go up to Mount Gerizim, where a certain impostor had promised to discover treasures to them; but this event did not happen before the year 35 of the common era, and consequently two years after the death of Jesus Christ. At the time of our Saviour's passion, Pilate made some endeavours to deliver him out of the hands of the Jews. He knew they had delivered him up, and pursued his life with so much violence, only out of malice and envy (Matt. xxvii. 18.). His wife, also, who had been disturbed the night before with frightful dreams, sent to tell him she desired him not to meddle in the affair of that just person (ib. 19.) He attempted to appease the wrath of the Jews, and to give them some satisfaction, by whipping Jesus Christ (John xix. 1. Matt. xxvii. 26.). He tried to take him out of their hands, by proposing to deliver him or Barabbas, on the day of the festival of the passover. Lastly, he had a mind to discharge himself from pronouncing judgment against him, by sending him to Herod king of Galilee (Luke xxiii. 7, 8.). When he saw all this would not satisfy the Jews, and that they even threatened him in some manner, saying he could be no friend to the emperor if he let him go (John xix. 12, 15.), he caused

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* Joseph. Antiq. lib. xviii. c. 5.

water to be brought, washed his hands before all the people, and publicly declared himself innocent of the blood of that just person (Matt. xxvii. 23, 24.); yet at the same time he delivered him up to his soldiers, that they might crucify him. This was enough to justify Jesus Christ, as Calmet observes, and to show that he held him as innocent; but it was not enough to vindicate the conscience and integrity of a judge, whose duty it was as well to assert the cause of oppressed innocence as to punish the guilty and criminal. He ordered to be put over our Saviour's cross, as it were an abstract of his sentence, and the motive of his condemnation (John xix. 9.), *Jesus of Nazareth, king of the Jews*, which was written in Latin, Greek, and Hebrew. Some of the Jews found fault with it, and remonstrated to Pilate that he ought to have written *Jesus of Nazareth who pretended to be king of the Jews.* But Pilate could not be prevailed with to alter it, and gave them this peremptory answer, *That what he had written he had written.*

Towards evening, he was applied to for leave to take down the bodies from the cross, that they might not continue there the following day, which was the passover and the sabbath-day (John xix. 31.). This he allowed, and granted the body of Jesus to Joseph of Arimathea, that he might pay his last duties to it, (ib. 33.). Lastly, when the priests, who had solicited the death of our Saviour, came to desire him to set a watch about the sepulchre, for fear his disciples should steal him away by night, he answered them, that they had a guard, and might place them there themselves (Matt. xxvii. 65.). This is the substance of what the gospel tells us concerning Pilate.

Justin Martyr, Tertullian, Eusebius, and after them several others both ancient and modern, assure us, that it was formerly the custom for Roman magistrates to prepare copies of all verbal processes and judicial acts which they passed in their several provinces, and to send them to the emperor. And Pilate, in compliance to this custom, having sent word to Tiberius of what had passed relating to Jesus Christ, the emperor wrote an account of it to the senate, in a manner that gave reason to judge that he thought favourably of the religion of Jesus Christ, and showed that he should be willing they would decree divine honours to him. But the senate was not of the same opinion, and so the matter was dropped. It appears by what Justin says of these acts, that the miracles of Jesus Christ were mentioned there, and even that the soldiers had divided his garments among them. Eusebius insinuates that they spoke of his resurrection and ascension. Tertullian and Justin refer to these acts with so much confidence as would make one believe they had them in their hands. However, neither Eusebius nor St Jerome, who were both inquisitive, understanding persons, nor any other author that wrote afterwards, seem to have seen them, at least not the true and original acts; for as to what we have now in great number, they are not authentic, being neither ancient nor uniform. There are also some pretended letters of Pilate to Tiberius, giving a history of our Saviour, but they are universally allowed to be spurious.

Pilate being a man that, by his excessive cruelties and rapine, had disturbed the peace of Judea during the whole time of his government, was at length deposed by Vitellius the proconsul of Syria, in the 36th year of Jesus Christ and sent to Rome to give an account of his conduct to the emperor. But though Tiberius died before Pilate arrived at Rome, yet his successor Caligula banished him to Vienne in Gaul, where he was reduced to such extremity that he killed himself with his own hands. The evangelists call him governor, though in reality he was no more than procurator of Judea, not only because governor was a name of general use, but because Pilate in effect acted as one, by taking upon him to judge in criminal matters; as his predecessors had done, and other procurators in the small provinces of the empire where there was no proconsul, constantly did. See *Calmet's Dictionary*, *Echard's Ecclesiastical Dictionary*, and *Beausobre's Annot.*

With regard to Pilate's wife, the general tradition is, that she was named Claudia Procula or Proscula; and in relation to her dream, some are of opinion that as she had intelligence of our Lord's apprehension, and knew by his character that he was a righteous person, her imagination, being struck with these ideas, did naturally produce the dream we read of; but others think that this dream was sent providentially upon her, for the clearer manifestation of our Lord's innocence.

PILATRE du Rozier, *Francis*, was born at Metz the 30th of March 1756. He was first apprentice to an apothecary there, and afterwards went to Paris in quest of farther improvement. He applied himself to the study of natural history and of natural philosophy, and had already acquired some reputation, when the discovery of M. de Montgolfier had just astonished the learned world. On the 25th of October 1783, he attempted an aerial voyage with the marquis of Arlande. He performed several other excursions in this way with brilliant success, in the presence of the royal family of France, of the king of Sweden, and of Prince Henry of Prussia. He then resolved to pass into England by means of his aerial vehicle, and for that purpose he repaired to Boulogne, whence he rose about 7 o'clock in the morning of the 15th June 1785; but in half an hour after he set out, the balloon took fire, and the aeronaut, with his companion M. Romaine, were crushed to death by the fall of that machine, which was more ingenious, perhaps, than useful *. Pilatre's social virtues and courage, which were very distinguished, heightened the regret of his friends for his loss. His merit as a chemist, and his experiments as an aeronaut, procured him some pecuniary reward, and some public appointments. He had a pension from the king, was intendant of Monsieur's cabinets of natural philosophy, chemistry, and natural history, professor of natural philosophy, a member of several academies, and principal director of Monsieur's museum.

PILCHARD, in *Ichthyology*, a fish which has a general resemblance to the herring, but differs in some essential particulars. The body of the pilchard is less compressed than that of the herring, being thicker and rounder: the nose is shorter in proportion, and turns up; the under jaw is shorter. The back is more elevated; the belly less sharp. The dorsal fin of the pilchard is placed exactly in the centre of gravity, so that when taken up by it, the body preserves an equilibrium, whereas that of the herring dips at the head. The scales of the pilchard adhere very closely, whereas those of the herring very easily drop off. The pilchard is in general less than the herring; but it is fatter, or more full of oil.

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* See *Aerostation*, N° 34.

The pilchard appears in vast shoals off the Cornish coasts about the middle of July, disappearing the beginning of winter, yet sometimes a few return again after Christmas. Their winter retreat is the same with that of the herring, and their motives for migrating the same †. They affect, during summer, a warmer latitude; for they are not found in any quantities on any of our coasts except those of Cornwall, that is to say, from Fowey harbour to the Scilly isles, between which places the shoals keep shifting for some weeks. The approach of the pilchard is known by much the same signs as those that indicate the arrival of the herring. Persons, called in Cornwall *huers*, are placed on the cliffs, to point to the boats stationed off the land the course of the fish. By the 1st of James I. c. 23. fishermen are empowered to go on the grounds of others to hue, without being liable to actions of trespass, which before occasioned frequent law-suits.

† See Clupea.

The emoluments that accrue to the inhabitants of that country are great, and are best expressed in the words of Dr W. Borlace, in his *Account of the Pilchard Fishery*. "It employs a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, at land, in salting, pressing, washing, and cleaning, in making boats, nets, ropes, casks, and all the trades depending on their construction and sale. The poor is fed with the offals of the captures; the land with the refuse of the fish and salt; the merchant finds the gains of commission and honest commerce; the fisherman, the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off at the same time part of our tin. The usual number of hogsheads of fish exported each year, for 10 years, from 1747 to 1756 inclusive, from the four ports of Fowey, Falmouth, Penzance, and St Ives, in all amounts to 29,794; since it appears that Fowey has exported yearly 1732 hogsheads; Falmouth, 14,631 hogsheads and two-thirds; Penzance and Mounts-Bay, 12,149 hogsheads and one-third; St Ives, 1282 hogsheads. Every hogshead for ten years last past, together with the bounty allowed for each when exported, and the oil made out of each, has amounted, one year with another at an average, to the price of 1l. 13s. 3d.; so that the cash paid for pilchards exported has, at a medium, annually amounted to the sum of 49,532l. 10s." The numbers that are taken at one shooting out of the nets is amazingly great. Mr Pennant says, that Dr Borlase assured him, that on the 5th of October 1767, there were at one time inclosed in St Ives bay 7000 hogsheads, each hogshead containing 35,000 fish, in all 245,000,000.

PILE, in *Heraldry*, an ordinary in form of a wedge, contracting from the chief, and terminating in a point towards the bottom of the shield.

Pile, among the Greeks and Romans, was a pyramid built of wood, whereon were laid the bodies of the deceased to be burnt. It was partly in the form of an altar, and differed in height according to the quality of the person to be consumed. Probably it might originally be considered as an altar, on which the dead were consumed as a burnt-offering to the infernal deities. The trees made use of in the erection of a funeral pile were such as abounded in pitch or rosin as being most combustible; if they used any other wood, it was split that it might the more easily catch fire. Round the pile were placed cypress boughs to hinder the noisome smell. See Funeral.

Pile, in *Building*, is used for a large stake rammed into the ground in the bottom of rivers, or in marshy land, for a foundation to build upon.

Pile is also used among architects for a mass of building.

Pile, in *Coinage*, denotes a kind of puncheon, which, in the old way of coining with the hammer, contained the arms or other figure and inscription to be struck on the coin. See Coinage.

Accordingly we still call the arms side of a piece of money the *pile*, and the head the *cross*; because in ancient coin, a cross usually took the place of the head in ours.

Plate CCCCXIX.

Pile-Engine, a very curious machine invented by Mr Vauloue for driving the piles of Westminster-bridge. A is a great upright shaft or axle, on which are the great wheel B, and the drum C, turned by horses joined to the bars S, S. The wheel B turns the trundle X, on the top of whose axis is the fly O, which serves to regulate the motion, and also to act against the horses, and to keep them from falling when the heavy ram Q is discharged to drive the pile P down into the mud in the bottom of the river. The drum C is loose upon the shaft A, but is locked to the wheel B by the bolt Y. On this drum the great rope HH is wound; one end of the rope being fixed to the drum, and the other to the follower G, to which it is conveyed over the pulleys I and K. In the follower G is contained the tongs F, that takes hold of the ram Q by the staple R, for drawing it up. D is a spiral or fusy fixed to the drum, on which is wound the small rope T that goes over the pulley U, under the pulley V, and is fastened to the top of the frame at 7. To the pulley-block V is hung the counterpoise W, which hinders the follower T from accelerating as it goes down to take hold of the ram; for as the follower tends to acquire velocity in its descent, the line T winds downwards upon the fusy, on a larger and larger radius, by which means the counterpoise W acts stronger and stronger against it; and so allows it to come down with only a moderate and uniform velocity. The bolt Y locks the drum to the great wheel, being pushed upward by the small lever 2, which goes through a mortise in the shaft A, turns upon a pin in the bar 3, fixed to the great wheel B, and has a weight 4, which always tends to push up the bolt Y through the wheel into the drum. L is the great lever turning on the axis *m*, and resting upon the forcing bar 5, 5, which goes through a hollow in the shaft A, and bears up the little lever 2.

By the horses going round, the great rope H is wound about the drum C, and the ram Q is drawn up by the tongs F in the follower G, until the tongs come between the inclined planes E; which, by shutting the tongs at the top, opens it at the foot, and discharges the ram, which falls down between the guides *b b* upon the pile P, and drives it by a few strokes as far into the mud as it will go; after which, the top part is sawed off close to the mud by an engine for that purpose. Immediately after the ram is discharged, the piece 6 upon the follower G takes hold of the ropes *a a*, which raise the end of the lever L, and causes its end N to descend and press down the forcing bar 5 upon the little lever

Machine for boring wooden PIPES. PLATE CCCCXIX.

Fig. 1.

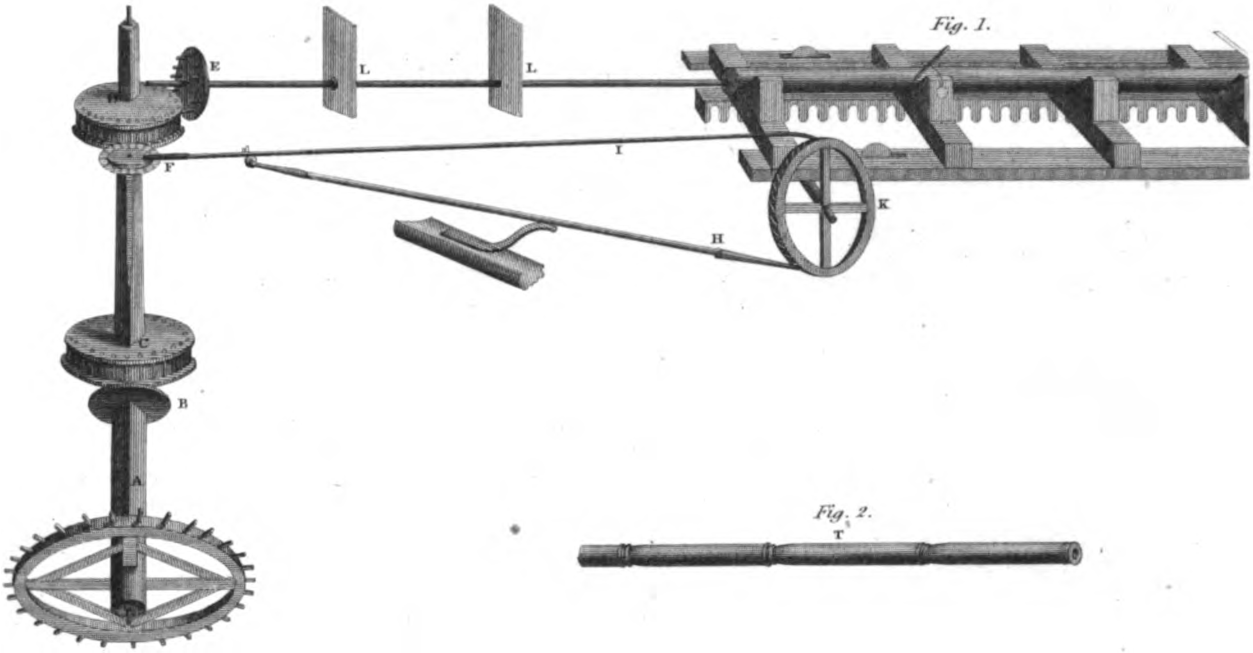


Fig. 2.

PILE Engine.

BUNCE'S PILE ENGINE.

Fig. 3.

Fig. 1.

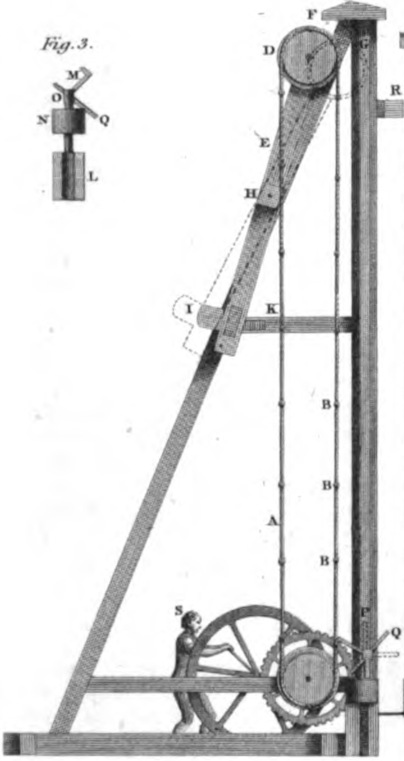
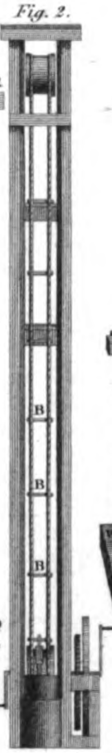
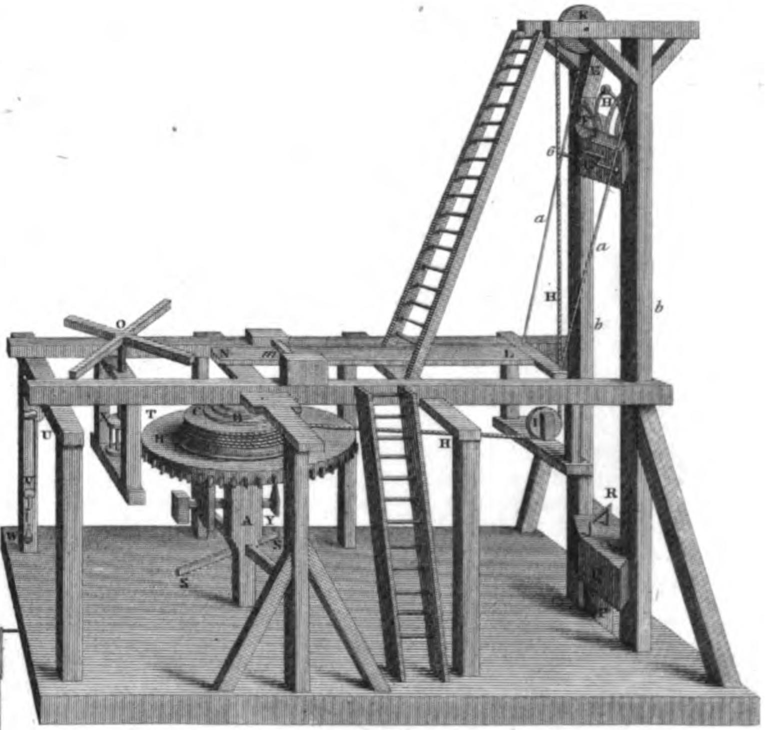


Fig. 2.



VAULOUE'S PILE ENGINE.



Williams sculp.

lever 2, which, by pulling down the bolt Y, unlocks the drum C from the great wheel B; and then the follower being at liberty, comes down by its own weight to the ram; and the lower ends of the tongs slip over the staple R, and the weight of their heads causes them to fall outward, and shut upon it. Then the weight 4 pushes up the bolt Y into the drum, which locks it to the great wheel, and so the ram is drawn up as before.

As the follower comes down, it causes the drum to turn backward, and unwinds the rope from it, whilst the horses, great wheel, trundle, and fly, go on with an uninterrupted motion; and as the drum is turning backward, the counterpoise W is drawn up, and its rope T wound upon the spiral fusy D.

There are several holes in the under side of the drum, and the bolt Y always takes the first one that it finds when the drum stops by the falling of the follower upon the ram; until which stoppage the bolt has not time to slip into any of the holes.

This engine was placed upon a barge on the water, and so was easily conveyed to any place desired. The ram was a ton weight; and the guides *b b*, by which it was let fall, were 30 feet high.

A new machine for driving piles has been invented by Mr Bunce of Kirby street, Hatton street, London. It will drive a greater number of piles in a given time than any other; and can be constructed more simply to work by horses than Mr Vauloue's engine above described.

Plate CCCCXIX. Fig. 1 and 2 represent a side and front section of the machine. The chief parts are A, fig. 1, which are two endless ropes, or chains, connected by cross pieces of iron B (see fig. 2), corresponding with two cross grooves cut diametrically opposite in the wheel C (fig. 1.), into which they are received; and by which means the rope or chain A is carried round. FHK is a side-view of a strong wooden frame moveable on the axis H. D is a wheel, over which the chain passes and turns within at the top of the frame. It moves occasionally from F to G upon the centre H, and is kept in the position F by the weight I fixed to the end K. Fig. 3. L is the iron ram, which is connected with the cross pieces by the hook M. N is a cylindrical piece of wood suspended at the hook at O, which by sliding freely upon the bar that connects the hook to the ram, always brings the hook upright upon the chain when at the bottom of the machine, in the position of GP. See fig. 1.

When the man at S turns the usual crane work, the ram being connected to the chain, and passing between the guides, is drawn up in a perpendicular direction; and when it is near the top of the machine, the projecting bar Q of the hook strikes against a cross piece of wood at R (fig. 1.); and consequently discharges the ram, whilst the weight I of the moveable frame instantly draws the upper wheel into the position shown at F, and keeps the chain free of the ram in its descent. The hook, while descending, is prevented from catching the chain by the wooden piece N. For that piece being specifically lighter than the iron weight below, and moving with a less degree of velocity, cannot come in contact with the iron till it is at the bottom and the ram stops. It then falls and again connects the hook with the chain, which draws up the ram, as before.

Mr Bunce has made a model of this machine, which performs perfectly well; and he observes, that, as the motion of the wheel C is uninterrupted, there appears to be the least possible time lost in the operation.

PILE-*Worms*, are a kind of worms found in the piles of the sea dikes in Holland. They are of very various sizes; for some of the young ones are not above an inch or two in length, while others have been found thirteen or fourteen inches long. The heads of these creatures are covered with two hard shells or hemicrania; which together form a figure resembling an augre; and with which they bore the wood. The best remedy against them is, to perforate the pile with many small holes about an inch asunder; then it must be done over with a varnish in the hottest sun; and, while the varnish is hot, brick dust must be strewed over it: and this being several times repeated, the pile will be covered with a strong crust absolutely impenetrable to all insects.

PILES, in *Medicine*, the same with hæmorrhoids. See MEDICINE, N° 240, &c.

PILEUS, in Roman antiquity, was the ordinary cap or hat worn at public shows and sacrifices, and by the freedmen. It was one of the common rewards assigned to such gladiators as were slaves, in token of their obtaining freedom.

PILEWORT, (*Ranunculus ficaria*, Lin.), the root. This is a very small plant, found in most meadows and by hedge sides. The roots consist of slender fibres with some little tubercles among them, which are supposed to resemble the hæmorrhoids. From thence it has been concluded, that this root must needs be of wonderful efficacy for the cure of that distemper: to the taste, it is little other than mucilaginous; and although still retained in several of the foreign pharmacopœias, it is hardly in use in this country.

PILGRIM, one who travels through foreign countries to visit holy places, and to pay his devotion to the relicks of dead saints. See PILGRIMAGE.

The word is formed from the Flemish *pelgrim*, or Italian *pelegrino*, which signifies the same; and those originally from the Latin *peregrinus*, a "stranger or traveller."

PILGRIMAGE, a kind of religious discipline, which consists in taking a journey to some holy place in order to adore the relicks of some deceased saint. Pilgrimages began to be made about the middle ages of the church; but they were most in vogue after the end of the 11th century, when every one was for visiting places of devotion, not excepting kings and princes themselves; and even bishops made no difficulty of being absent from their churches on the same account. The places most visited were Jerusalem, Rome, Compostella (A), and Tours; but the greatest numbers now resort

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(A) It deserves to be remarked here, that in the year 1428, under the reign of Henry VI. abundance of licences were granted from the crown of England to captains of English ships, for carrying numbers of devout persons to the shrine of St James of Compostella in Spain; provided, however, that those pilgrims should first take an oath resort to Loretto, in order to visit the chamber of the blessed virgin, in which she was born, and brought up her son Jesus till he was 12 years of age. For the pilgrimage of the followers of Mahomet, see **Mahometanism.**

In every country where popery was established, pilgrimages were common; and in those countries which are still popish, they continue. In England, the shrine of St Thomas à Becket was the chief resort of the pious; and in Scotland, St Andrews; where, as tradition informs us, was deposited a leg of the holy apostle. In Ireland they still continue; for, from the beginning of May till the middle of August every year, crowds of popish penitents from all parts of that country resort to an island near the centre of *Lough-fin*, or *White Lake*, in the county of Donnegal, to the amount of 3000 or 4000. These are mostly of the poorer sort, and many of them are proxies for those who are richer; some of which, however, together with some of the priests and bishops on occasion, make their appearance there. When the pilgrim comes within sight of the holy lake, he must uncover his hands and feet, and thus walk to the water side, and is taken to the island for sixpence. Here there are two chapels and 15 other houses; to which are added confessionals, so contrived, that the priest cannot see the person confessing. The penance varies according to the circumstances of the penitent; during the continuance of which (which is sometimes three, six, or nine days) he subsists on oatmeal, sometimes made into bread. He traverses sharp stones on his bare knees or feet, and goes through a variety of other forms, paying sixpence at every different confession. When all is over, the priest bores a gimblet-hole through the pilgrim's staff near the top, in which he fastens a cross peg; gives him as many holy pebbles out of the lake as he cares to carry away, for amulets to be presented to his friends, and so dismisses him, an object of veneration to all other papists not thus initiated, who no sooner see the pilgrim's cross in his hands, than they kneel down to get his blessing.

There are, however, other parts of Ireland sacred to extraordinary worship and pilgrimage; and the number of holy wells, and miraculous cures, &c. produced by them, is very great. That such things should exist in this enlightened age, and in a Protestant country, is indeed strange; but our wonder ceases, when we reflect that it is among the lowest, and perhaps the worst of the people. They who carry external religion to an extreme, and place that confidence in ceremony which belongs only to the spirit of it, are seldom distinguished either for their wisdom or their virtue. We do not deny, however, that they who carry matters to the other extreme, may be equally destitute of real knowledge and genuine morality.

Dr Johnson, in his *Rasselas*, gives us some observations on pilgrimage, which are so much to the purpose, that we think we cannot do better than lay them before our readers. "Pilgrimage (said Imlac, into whose mouth the observations are put), like many other acts of piety, may be reasonable or superstitious according to the principles upon which it is performed. Long journeys in search of truth are not commanded. Truth, such as is necessary to the regulation of life, is always found where it is honestly sought: change of place is no natural cause of the increase of piety, for it inevitably produces dissipation of mind. Yet since men go every day to view the fields where great actions have been performed, and return with stronger impressions of the event, curiosity of the same kind may naturally dispose us to view that country whence our religion had its beginning: and I believe no man surveys those awful scenes without some confirmation of holy resolutions. That the Supreme Being may be more easily propitiated in one place than in another, is the dream of idle superstition; but that some places may operate upon our own minds in an uncommon manner, is an opinion which hourly experience will justify. He who supposes that his vices may be more successfully combated in Palestine, will, perhaps, find himself mistaken; yet he may go thither without folly: he who thinks they will be more freely pardoned, dishonours at once his reason and religion."

PILKINGTON, Lætitia, a famous poetical genius, the daughter of Dr Van Lewin, a physician of Dublin, where she was born in 1712. She was married very young to the Rev. Matthew Pilkington, a poet also of no inconsiderable merit; and the two wits, as is often the case, lived very unhappily together. They were at length totally separated, on the husband accidentally discovering a gentleman in her bedchamber at two o'clock in the morning; a circumstance which she accounted for in a very unsatisfactory manner. The story is told at large in her Memoirs where she says, "Lovers of Learning, I am sure, will pardon me, as I solemnly declare it was the attractive charms of a new book, which the gentleman would not lend me, but consented to stay till I read it through, that was the sole motive of my detaining him." As there are not wanting some who form objections to marrying learned wives, the chance of such literary assignations may perhaps be added to the list of them. After this unlucky adventure, Mrs Pilkington came to London; and having recourse to her pen for subsistence, through the means of Colley Cibber, she lived for some time on the contributions of the great. She was however thrown into the Marshalsea for debt; and being set a liberty, opened a pamphlet shop. She raised at length a handsome subscription for her Memoirs; which are written with great sprighliness and wit, containing several entertaining anecdotes of Dean Swift, with whom she was intimate, as well as many pretty little pieces of her own poetry. This ingenious woman is said at last to have killed herself with drinking. She died at Dublin, in 1750.

PILL, in *Pharmacy*, a form of medicine resembling a little ball, to be swallowed whole; invented for such

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not to take any thing prejudicial to England, not to reveal any of its secrets, nor to carry out with them any more gold or silver than what would be sufficient for their reasonable expences. In this year there went out thither from England, on the said pilgrimage, the following number of persons. From London 280 Bristol 200, Weymouth 122, Dartmouth 90, Yarmouth 60, Jersey 60, Plymouth 40, Exeter 30, Poole 24, Ipswich 20, in all 926 persons.

as cannot take bitter and ill-tasted medicinal draughts: as also to keep in readiness for occasional use without decaying. See MATERIA MEDICA *Index*.

PILLAR, in *Architecture*. See ARCHITECTURE.

PILLAR, in the manege, is the centre of the ring, or manege-ground, round which a horse turns, whether there be a pillar in it or not. Besides this, there are pillars on the circumference or sides of the manege-ground, placed at certain distances, by two and two, from whence they are called the *two pillars*, to distinguish them from that of the centre. The use of the pillar in the centre is for regulating the extent of ground, that the manege upon the volts may be performed with method and justness, and that they may work in a square, by rule and measure, upon the four lines of the volts; and also to break unruly high-mettled horses, without endangering the rider. The two pillars are placed at the distance of two or three paces one from the other; and the horse is put between those, to teach him to rise before and yerk out behind, and put himself upon raised airs, &c. either by the aids or chastisements.

Pompey's PILLAR. See ALEXANDRIA.

PILLARS, in antiquarian topography, are large single stones set up perpendicularly. Those of them which are found in this country have been the work of the Druids; but as they are the most simple of all monuments, they are unquestionably more ancient than druidism itself. They were placed as memorials recording different events; such as remarkable instances of God's mercies, contracts, singular victories, boundaries, and sometimes sepulchres. Various instances of these monuments erected by the patriarchs occur in the Old Testament: such was that raised by Jacob at Luz, afterwards by him named *Bethel;* such also was the pillar placed by him over the grave of Rachel. They were likewise marks of execrations and magical talismans.

These stones, from having long been considered as objects of veneration, at length were by the ignorant and superstitious idolatrously worshipped; wherefore, after the introduction of Christianity, some had crosses cut on them, which was considered as snatching them from the service of the devil. Vulgar superstition of a later date has led the common people to consider them as persons transformed into stone for the punishment of some crime, generally that of sabbath-breaking; but this tale is not confined to single stones, but is told also of whole circles: witness the monuments called the *hurlers* in Cornwall, and *Rollorick stones* in Warwickshire. The first are by the vulgar supposed to have been once men, and thus transformed as a punishment for playing on the Lord's day at a game called *hurling;* the latter, a pagan king and his army.

At Wilton, where the earl of Pembroke has a very magnificent house, there is a pillar of one piece of white Egyptian granite, which was brought from the temple of Venus Genetrix at Rome, near 14 feet high and 22 inches diameter, with an inscription to Astarte or Venus.

PILLORY (*collistrigium*, "collum stringens;" *pilloria*, from the French *pilleur*, i. e. *depeculator;* or *pelori*, derived from the Greek πυλη, *janua*, a "door," because one standing on the pillory puts his head as it were through a door, and ὁραω, *video*), is an engine made of wood to punish offenders, by exposing them to public view, and rendering them infamous. There is a *statute of the pillory*, 51 Hen. III. And by statute it is appointed for bakers, forestallers, and those who use false weights, perjury, forgery, &c. 3. *Inst.* 219. Lords of leets are to have a pillory and tumbrel, or it will be the cause of forfeiture of the leet; and a village may be bound by prescription to provide a pillory, &c. 2 *Hawk.* P. C. 73.

PILOT, the officer who superintends the navigation, either upon the sea-coast or on the main ocean. It is, however, more particularly applied by our mariners to the person charged with the direction of a ship's course on or near the sea-coast, and into the roads, bays, rivers, havens, &c. within his respective district.

Pilots of ships, taking upon them to conduct any ship from Dover, &c. to any place up the river Thames, are to be first examined and approved by the master and wardens of the society of Trinity House, &c. or shall forfeit 10l. for the first offence, 20l. for the second, and 40l. for every other offence; one moiety to the informer, the other to the master and wardens; but any master or mate of a ship may pilot his own vessel up the river: and if any ship be lost through the negligence of any pilot, he shall be for ever after disabled to act as a pilot. 3 Geo. I. c. 13. Also the lord-warden of the cinque ports may make rules for the government of pilots, and order a sufficient number to ply at sea to conduct ships up to the Thames: 7 Geo. I. c. 21. No person shall act as a pilot on the Thames, &c. (except in collier ships) without a licence from the master and wardens of Trinity House at Deptford, on pain of forfeiting 20l. And pilots are to be subject to the government of that corporation; and pay ancient dues, not exceeding 1s. in the pound, out of wages, for the use of the poor thereof. Stat. 5 Geo. II. c. 20.

By the former laws of France, no person could be received as pilot till he had made several voyages and passed a strict examination; and after that, on his return in long voyages, he was obliged to lodge a copy of his journal in the admiralty; and if a pilot occasioned the loss of a ship, he had to pay 100 livres fine, and to be for ever deprived of the exercise of pilotage; and if he did it designedly, be punished with death. *Lex Mercat.* 70, 71.

The laws of Oleron ordain, That if any pilot designedly misguide a ship, that it may be cast away, he shall be put to a rigorous death, and hung in chains: and if the lord of a place, where a ship be thus lost, abet such villains in order to have a share of the wreck, he shall be apprehended, and all his goods forfeited for the satisfaction of the persons suffering; and his person shall be fastened to a stake in the midst of his own mansion, which, being fired on the four corners, shall be burned to the ground, and he with it. *Leg. Ol.* c. 25. And if the fault of a pilot be so notorious that the ship's crew see an apparent wreck, they may lead him to the hatches, and strike off his head; but the common law denies this hasty execution: an ignorant pilot is sentenced to pass thrice under the ship's keel by the laws of Denmark. *Lex Mercat.* 70.

The regulations with regard to pilots in the royal navy are as follow: "The commanders of the king's ships, in order to give all reasonable encouragement to so useful a body of men as pilots, and to remove all their objections to his majesty's service, are strictly charged to treat them with good usage, and an equal respect with warrant officers.

"The purser of the ship is always to have a set of bedding provided on board for the pilots; and the captain is to order the boatswain to supply them with hammocks, and a convenient place to lie in, near their duty, and apart from the common men; which bedding and hammocks are to be returned when the pilots leave the ship.

"A pilot, when conducting one of his majesty's ships in pilot-water, shall have the sole charge and command of the ship, and may give orders for steering, setting, trimming, or furling the sails; tacking the ship; or whatever concerns the navigation; and the captain is to take care that all the officers and crew obey his orders. But the captain is diligently to observe the conduct of the pilot; and if he judges him to behave so ill as to bring the ship into danger, he may remove him from the command and charge of the ship, and take such methods for her preservation as shall be judged necessary; remarking upon the log book, the exact hour and time when the pilot was removed from his office, and the reasons assigned for it.

"Captains of the king's ships, employing pilots in foreign parts of his majesty's dominions, shall, after performance of the service, give a certificate thereof to the pilot, which being produced to the proper naval officer, he shall cause the same to be immediately paid; but if there be no naval officer there, the captain of his majesty's ship shall pay him, and send the proper vouchers, with his bill, to the navy-board, in order to be paid as bills of exchange.

"Captains of his majesty's ships, employing foreign pilots to carry the ships they command into or out of foreign ports, shall pay them the rates due by the establishment or custom of the country, before they discharge them: whose receipts being duly vouched, and sent, with a certificate of the service performed, to the navy-board, they shall cause them to be paid with the same exactness as they do bills of exchange." *Regulations and Instructions of the Sea-service*, &c.

Pilot-Fish. See Gasterosteus, Ichthyology *Index*.

Osbec tells us, that they are shaped like those mackerels which have a transverse line upon the body. "Sailors (continues he) give them the name of *pilots*, because they closely follow the dog fish, swimming in great shoals round it on all sides. It is thought that they point out some prey to the dog-fish. They are not only not touched, but also preserved by it against all their enemies.

It likewise follows the shark, apparently for the purpose of devouring the remains of its prey. It is pretended that it acts as its pilot. The manner in which it attends the shark, according to M. Daubenton, may have given rise to this name. It is said to swim at the height of a foot and a half from the snout of this voracious animal, to follow and imitate all its movements, and to seize with address every part of its prey which the shark allows to escape, and which is light enough to buoy up towards the surface of the water. When the shark, which has its mouth below, turns to seize any fish, the pilot-fish starts away; but as soon as the shark resumes his ordinary position, it returns to its former place. It is said, that in the gulf of Guinea those fishes follow ships for the sake of the offals and human excrements; and hence the Dutch give them the name of *dung-fish*. It is remarkable, that though so small they can keep pace with ships in their swiftest course.

PILTEN, a division of Courland, which lies in Courland properly so called, derives its name from the ancient castle or palace of Pilten, built by Valdemar II. King of Denmark about the year 1220, when he founded a bishop's see in this country for the more effectual conversion of its Pagan inhabitants. This district afterwards successively belonged to the Germans, then again to the king of Denmark, the duke of Courland, and to Poland; and by virtue of the instrument of regency drawn up for this district in the year 1717, the government is lodged in seven Polish senators or counsellors, from whom an appeal lies to the king. The bishop of Samogitia also styles himself bishop of Pilten.

The most remarkable part of this district is the promontory of Domesness, which projects northward into the gulf of Livonia. From this cape, a sand-bank runs four German miles farther into the sea, half of which lies under water, and cannot be discerned. To the east of this promontory is an unfathomable abyss, which is never observed to be agitated. For the safety of vessels bound to Livonia, two square beacons have been erected on the coast, near Domesness church, opposite to the sand bank, and facing each other. One of these is twelve fathoms high, and the other eight; and a large fire is kept burning on them from the first of August to the first of January. When the mariners see these fires appear as one in a direct line, they may conclude that they are clear of the extremity of the sand bank, and consequently out of danger; but if they see both beacons, they are in danger of running upon it. The district of Pilten contains seven parishes, but no towns worthy of notice. The inhabitants are chiefly of the Lutheran persuasion.

PILUM, a missive weapon used by the Roman soldiers, and in a charge darted upon the enemy. Its point, we are told by Polybius, was so long and small, that after the first discharge it was generally so bent as to be rendered useless. The legionary soldiers made use of the pilum, and each man carried two. The pilum underwent many alterations and improvements, insomuch that it is impossible with any precision to describe it. Julius Scaliger laboured much to give an accurate account of it, and would have esteemed success on this head amongst the greatest blessings of his life. This weapon appears, however, to have been sometimes round, but most commonly square, to have been two cubits long in the staff, and to have had an iron point of the same length hooked and jagged at the end. Marius made a material improvement in it; for during the Cimbrian war, he so contrived it, that when it stuck in the enemies shield it should bend down in an angle in the part where the wood was connected with the iron, and thus become useless to the person who received it.

PIMENTO, Piemento, Jamaica Pepper, or *Allspice*, a species of myrtus. See Myrtus, Botany *Index*.

"The pimento trees grow spontaneously, and in great abundance, in many parts of Jamaica, but more particularly on hilly situations near the sea, on the northern side of that island; where they form the most delicious groves that can possibly be imagined; filling the air with fragrance, and giving reality, though in a very distant part of the globe, to our great poet's description of those balmy gales which convey to the delighted voyager

' Sabean odours from the spicy shore
' Of Araby the blest.
' Cheer'd with the grateful smell, old ocean smiles.'

" This tree is purely a child of nature, and seems to mock all the labours of man in his endeavours to extend or improve its growth: not one attempt in fifty to propagate the young plants, or to raise them from the seeds, in parts of the country where it is not found growing spontaneously, having succeeded. The usual method of forming a new pimento plantation (in Jamaica it is called a *walk*) is nothing more than to appropriate a piece of woodland, in the neighbourhood of a plantation already existing, or in a country where the scattered trees are found in a native state, the woods of which being fallen, the trees are suffered to remain on the ground till they become rotten and perish. In the course of twelve months after the first season, abundance of young pimento plants will be found growing vigorously in all parts of the land, being without doubt produced from ripe berries scattered there by the birds, while the fallen trees, &c. afford them both shelter and shade. At the end of two years it will be proper to give the land a thorough cleansing, leaving such only of the pimento trees as have a good appearance, which will then soon form such groves as those I have described, and except perhaps for the first four or five years, require very little attention afterwards.

" Soon after the trees are in blossom, the berries become fit for gathering; the fruit not being suffered to ripen on the tree, as the pulp in that state, being moist and glutinous, is difficult to cure, and when dry becomes black and tasteless. It is impossible, however, to prevent some of the ripe berries from mixing with the rest; but if the proportion of them be great, the price of the commodity is considerably injured.

" It is gathered by the hand; one labourer on the tree, employed in gathering the small branches, will give employment to three below (who are generally women and children) in picking the berries; and an industrious picker will fill a bag of 70lbs. in the day.

" The returns from a pimento walk in a favourable season are prodigious. A single tree has been known to yield 150lbs. of the raw fruit, or one cwt. of the dried spice; there being commonly a loss in weight of one third in curing; but this, like many other of the minor productions, is exceedingly uncertain, and perhaps a very plenteous crop occurs but once in five years."

PIMPINELLA, BURNET SAXIFRAGE; a genus of plants belonging to the pentandria class. See BOTANY *Index*.

PIMPLE, in *Medicine*, a small pustule arising on the face. By mixing equal quantities of the juice of house-leek (*sedum minus*), passed through paper, and of spirit of wine rectified by itself, a white coagulum of a very volatile nature is formed, which Dr Bughart commends for curing pimples of the face; and says, that the thin liquor separated from it with sugar-candy is an excellent remedy for thick viscid phlegm in the breast.

PIN, in commerce, a little necessary instrument made of brass-wire, chiefly used by women in fastening and adjusting their dress.

In the year 1543, by statute 34 and 35 of Henry VIII. cap. 6. it was enacted, " That no person shall put to sale any pinnes but only such as shall be double-headed, and have the heads soldered fast to the shank of the pins, well smoothed, the shank well-shapen, the points well and round filed, cauted, and sharpened." From the above extract it should appear that the art of pin-making was but of late invention, probably introduced from France; and that our manufactories since that period have wonderfully improved.

Though pins are apparently simple, their manufacture is, however, not a little curious and complex. We shall therefore give our readers an account of it from Ellis's *Campagna* of London.

" When the brass-wire, of which the pins are formed, is first received at the manufactory, it is generally too thick for the purpose of being cut into pins. The first operation therefore is that of winding it off from one wheel to another with great velocity, and causing it to pass between the two, through a circle in a piece of iron of smaller diameter: the wire being thus reduced to its proper dimensions, is straightened by drawing it between iron pins, fixed on a board in a zig-zag manner, but so as to leave a straight line between them: afterwards it is cut into lengths of three or four yards, and then into smaller ones, every length being sufficient to make six pins; each end of these is ground to a point, which was performed when I viewed the manufactory by boys who sat each with two small grinding stones before him, turned by a wheel. Taking up a handful, he applies the ends to the coarsest of the two stones, being careful at the same time to keep each piece moving round between his fingers, so that the points may not become flat: he then gives them a smoother and sharper point, by applying them to the other stone, and by that means a lad of 12 or 14 years of age is enabled to point about 16,000 pins in an hour. When the wire is thus pointed, a pin is taken off from each end, and this is repeated till it is cut into six pieces. The next operation is that of forming the heads, or, as they term it, *head spinning*; which is done by means of a spinning-wheel, one piece of wire being thus with astonishing rapidity wound round another, and the interior one being drawn out, leaves a hollow tube between the circumvolutions: it is then cut with sheers; every two circumvolutions or turns of the wire forming one head; these are softened by throwing them into iron pans, and placing them in a furnace till they are red hot. As soon as they are cold, they are distributed to children, who sit with anvils and hammers before them, which they work with their feet, by means of a lathe, and taking up one of the lengths, they thrust the blunt end into a quantity of the heads which lie before them, and catching one at the extremity, they apply them immediately to the anvil and hammer, and by a motion or two of the foot, the point and the head are fixed together in much less time than can it be described, and with a dexterity only to be acquired by practice; the spectator being in continual apprehension for the safety of their fingers ends. The pin is now finished as to its form, but still it is merely brass; it is therefore thrown into a copper containing a solution of tin and the leys of wine. Here it remains for some time; and when taken out assumes a white though dull appearance: in order therefore to give it a polish, it is put into a tub containing a quantity of bran, which is set in motion by turning a shaft that runs through its centre, and thus by means of friction it becomes perfectly bright. The pin being complete, nothing remains but to separate it from the bran, which is performed by a mode exactly similar to the winnowing of corn; the bran flying off and leaving the pin behind fit for immediate sale. I was the more pleased with this manufactory, as it appeared to afford employment to a number of children of both sexes, who are thus not only prevented from acquiring the habits of idleness and vice, but are on the contrary initiated in their early years in those of a beneficial and virtuous industry." See NEEDLES.

PINACIA, among the Athenians, were tablets of brass inscribed with the names of all those citizens in each tribe who were duly qualified and willing to be judges of the court of Areopagus. These tablets were cast into a vessel provided for the purpose, and the same number of beans, a hundred being white and all the rest black, were thrown into another. Then the names of the candidates and the beans were drawn out one by one, and they whose names were drawn out together with the white beans were elected judges or senators. In Solon's time there were only four tribes, each of which chose 100 senators; but the number of tribes afterwards increasing, the number of senators and judges increased to so many hundreds more.

PINANG, the Chinese name of the *Areca Catechu* Lin. See ARECA, BOTANY *Index*.

PINCHBECK, a factitious metallic substance, or an alloy of zinc three parts, and of copper, four. See CHEMISTRY *Index*.

PINDAR, the prince of lyric poets, was born at Thebes, about 520 years B. C. He received his first musical instructions from his father, who was a flute-player by profession; after which, according to Suidas, he was placed under Myrtis, a lady of distinguished abilities in lyric poetry. It was during this period that he became acquainted with the poetess Corinna, who was likewise a student under Myrtis. Plutarch tells us, that Pindar profited from the lessons which Corinna, more advanced in her studies, gave him at this school. It is very natural to suppose, that the first poetical effusions of a genius so full of fire and imagination as that of Pindar would be wild and luxuriant; and Lucian has preserved six verses, said to have been the exordium of his first essay; in which he crowded almost all the subjects for song which ancient history and mythology then furnished. Upon communicating this attempt to Corinna, she told him smiling, that he should sow with the hand, and not empty his whole sack at once. Pindar, however, soon quitted the leading strings of these ladies, his poetical nurses, and became the disciple of Simonides, now arrived at extreme old age: after which he soon surpassed all his masters, and acquired great reputation over all Greece: but, like a true prophet, he was less honoured in his own country than elsewhere; for at Thebes he was frequently pronounced to be vanquished, in the musical and poetical contests, by candidates of inferior merit.

The custom of having these public trials of skill in all the great cities of Greece was now so prevalent, that but little fame was to be acquired by a musician or poet any other way than by entering the lists; and we find, that both Myrtis and Corinna publicly disputed the prize with him at Thebes. He obtained a victory over Myrtis, but was vanquished five different times by Corinna. The judges, upon occasions like these, have been frequently accused of partiality or ignorance, not only by the vanquished, but by posterity; and if the merit of Pindar was pronounced inferior to that of Corinna five several times, it was, says Pausanias, because the judges were more sensible to the charms of beauty than to those of music and poetry (A). Was it not strange, said the Scythian Anacharsis, that the Grecian artists were never judged by artists, their peers?

Pindar, before he quitted Thebes, had the vexation to see his Dithyrambics traduced, abused, and turned into ridicule, by the comic poets of his time; and Athenæus tells us, that he was severely censured by his brother lyrics, for being a lipogrammatist, and composing an ode from which he had excommunicated the letter S. Whether these censures proceeded from envy or contempt cannot now be determined; but they were certainly useful to Pindar, and it was necessary that he should be lashed for such puerilities. Thebes seems to have been the purgatory of our young bard: when he quitted that city, as his judgement was matured, he avoided most of the errors for which he had been chastised, and suddenly became the wonder and delight of all Greece. Every hero, prince, and potentate, desirous of lasting fame, courted the muse of Pindar.

He seems frequently to have been present at the four great festivals, of the Olympian, Pythian, Nemean, and Isthmian games, as may be inferred from several circumstances and expressions in the odes which he composed for the victors in them all. Those at Olympia, who were ambitious of having their achievements celebrated by Pindar, applied to him for an ode, which was first sung in the Prytaneum or town-hall of Olympia, where there was a banqueting room, set apart for the entertainment of the conquerors. Here the ode was rehearsed by a chorus, accompanied by instruments. It was afterwards performed in the same manner at the triumphal entry of the victor into his own country, in processions, or at the sacrifices that were made with great pomp and solemnity on the occasion.

(A) Pausanias says, that Corinna was one of the most beautiful women of her time, as he judged by a picture of her which he saw at Tanagris at the place where the public exercises were performed. She was represented with her head ornamented by a riband, as a memorial of the victories she had obtained over Pindar at Thebes.

Pindar, in his second Isthmian ode, has apologized for the mercenary custom among poets, of receiving money for their compositions. "The world (says he) is grown interested, and thinks in general with the Spartan philosopher Aristodemus, that *money only makes the man*: a truth which this sage himself experienced, having with his riches lost all his friends." It is supposed that Pindar here alludes to the avarice of Simonides, who first allowed his muse to sell her favours to the highest bidder.

There is no great poet in antiquity whose moral character has been less censured than that of Pindar. Plutarch has preserved a single verse of his *Epicedium* or *Dirge* that was sung at his funeral; which, short and simple as it is, implies great praise: *This man was pleasing to strangers, and dear to his fellow-citizens.* His works abound with precepts of the purest morality: and it does not appear that he ever traduced even his enemies; comforting himself, for their malignity, by a maxim which he inserted in his first *Pythic*, and which afterwards became proverbial, *That it is better to be envied than pitied.*

Pausanias says, that the character of poet was truly consecrated in the person of Pindar, by the god of verse himself; who was pleased, by an express oracle, to order the inhabitants of Delphos to set apart for Pindar one half of the first-fruit offerings brought by the religious to his shrine, and to allow him a conspicuous place in his temple, where, in an iron chair, he used to sit and sing his hymns in honour of that god. This chair was remaining in the time of Pausanias, several centuries after, and shown to him as a relick not unworthy of the sanctity and magnificence of that place.

But though Pindar's muse was pensioned at Delphos, and well paid by princes and potentates elsewhere, she seems, however, sometimes to have sung the spontaneous strains of pure friendship. Of this kind were, probably, the verses bestowed upon the musician Midas, of Agrigentum in Sicily, who had twice obtained the palm of victory by his performance on the flute at the Pythic games (B). It is in his 12th Pythic ode that Pindar celebrates the victory of Midas *over all Greece, upon that instrument which Minerva herself had invented* (C).

Fabricius tells us, that Pindar lived to the age of 90; and, according to the chronology of Dr Blair, he died 435 years B. C. aged 86. His fellow citizens erected a monument to him in the Hippodrome at Thebes, which was still subsisting in the time of Pausanias; and his renown was so great after his death, that his posterity derived very considerable honours and privileges from it. When Alexander the Great attacked the city of Thebes, he gave express orders to his soldiers to spare the house and family of Pindar. The Lacedæmonians had done the same before this period; for when they ravaged Bœotia and burned the capital, the following words were written upon the door of the poet: *Forbear to burn this house; it was the dwelling of Pindar.* Respect for the memory of this great poet continued so long, that, even in Plutarch's time, the best part of the sacred victim at the Theoxenian festival was appropriated to his descendants.

PINDARIC ODE, in *Poetry*, an ode formed in imitation of the manner of Pindar. See POETRY, N° 136, &c.

PINDUS, in *Ancient Geography*, not a single mountain, but a chain of mountains, inhabited by different people of Epirus and Thessaly; separating Macedonia, Thessaly, and Epirus: An extensive chain, having Macedonia to the north, the Perrhœbi to the west, the Dolopes to the south, and the mountain itself of Thessaly (Strabo).

PINDUS, a Doric city of Ætolia, situated on the cognominal river, which falls into the Cephissus (Strabo).

PINE, in *Botany*. See PINUS, BOTANY *Index*.

PINE-Apple. See BROMELIA, BOTANY *Index*; and for an account of the mode of cultivating the pine-apple, see GARDENING.

PINEA, or PIGNE, in commerce, is a term used in Peru and Chili, for a kind of light, porous masses, or lumps, formed of a mixture of mercury and silver-dust from the mines. The ore, or mineral, of silver, when dug out of the veins of the mine, is first broken and then ground in mills for the purpose, driven by water with iron pestles, each of 200 pounds weight. The mineral, when thus pulverized, is next sifted, and then worked up with water into a paste; which, when half dry, is cut into pieces, called *cuerpos*, a foot long, weighing each about 2500 pounds.

Each piece or cuerpo is again kneaded up with sea-salt, which, dissolving, incorporates with it. They then add mercury, from 10 to 20 pounds for each cuerpo, kneading the paste afresh until the mercury be incorporated therewith. This office, which is exceedingly dangerous on account of the noxious qualities of the mercury, is always made the lot of the poor Indians. This amalgamation is continued for eight or nine days; and some add lime, lead, or tin ore, &c. to forward it; and, in some mines, they are obliged to use fire. To try whether or no the mixture and amalgamation be sufficient, they wash a piece in water; and if the mercury be white, it is a proof that it has had its effect: if black, it must be still farther worked.

(B) This Midas is a very different personage from his long-eared majesty of Phrygia, whose decision in favour of Pan had given such offence to Apollo; as is manifest, indeed, from his having been contemporary with Pindar.

(C) The most extraordinary part of this musician's performance that can be gathered from the scholiast upon Pindar, was his finishing the solo, without a reed or mouth-piece, which broke accidentally while he was playing. The legendary account given by the poet in this ode, of the occasion upon which the flute was invented by Minerva, is diverting: "It was (says he) to imitate the howling of the Gorgons, and the hissing of their snakes, which the goddess had heard when the head of Medusa (one of these three anti-graces) was cut off by Perseus."

ed. When finished, it is sent to the lavatories, which are large basons that empty successively into one another. The paste, &c. being laid in the uppermost of these, the earth is then washed from it into the rest by a rivulet turned upon it; an Indian, all the while, stirring it with his feet, and two other Indians doing the like in the other basons. When the water runs quite clear out of the basons, the mercury and silver are found at bottom incorporated. This matter they call *pella*, and of this they form the pineas, by expressing as much of the mercury as they can; first, by putting it in woollen bags, and pressing and beating it strongly; then, by stamping it in a kind of wooden mould, of an octagonal form, at bottom whereof is a brass plate pierced full of little holes. The matter, when taken out of the mould, is laid on a trivet, under which is a large vessel full of water; and the whole being covered with an earthen head, a fire is made round it.

The mercury still remains in the mass, and is thus reduced into fumes, and, at length, condensing, it is precipitated into the water, leaving behind it a mass of silver grains of different figures, which, only joining or touching at the extremes, render the matter very porous and light. This, therefore, is the pinea, or pigne, which the workmen endeavour to sell, secretly to vessels trading to the South sea; and from which those, who have ventured to engage in so dangerous a commerce, have made such vast gains. Indeed the traders herein must be very careful; for the Spanish miners are arrant knaves, and to make the pignes weigh the more, they often fill the middle with sand or iron.

PINEAL GLAND. See BRAIN, ANATOMY *Index*.

PINEAU, GABRIEL DU, a distinguished lawyer, was born at Angers in 1573. He went afterwards to Paris, and pled with eclat before the parliament and great council. Upon his return to Angers, he became a counsellor in the presidial court. He was consulted by all the neighbouring provinces, and had an active hand in all the great affairs of his time. Mary de Medicis conferred upon him the office of master of requests, and in her disgrace wished to support herself by his credit and counsels; but Du Pineau, always attentive to what he owed on the one hand to the mother of his king, and on the other to the king himself, never ceased to inspire that princess with sentiments of peace.

In 1632 Louis XIII. by way of reward, appointed him mayor and captain-general of the city of Angers; a situation in which he merited the flattering title of *Father of the People*. He had no respect of persons; for he was equally accessible to the poor and the great. This worthy citizen died the 15th of October 1644, at the age of 71. His house was a kind of academy, where regular conferences were held, and attended by young officers, advocates, and other literary characters. In those conferences every one freely stated the difficulties which occurred to him upon subjects either of law or history; and when Pineau spoke, all was made clear; but he was always the last in delivering his sentiments, because he perceived that too much deference was paid to his opinion. His writings are, 1. Latin notes, in addition to those of Du Moulin, upon the canon law, and printed along with the works of that eminent lawyer by the care of Francis Pinson. 2. Commentaries, observations, and consultations, upon several important questions respecting the laws both of Anjou and of France, with some dissertations upon different subjects, &c. reprinted in 1725, in 2 vols. folio, by the care of Livoniere, who has enriched them with very useful remarks. The editor says, that "Du Pineau is a little inferior to the celebrated Du Moulin on the civil law, but that he is more accurate than the other upon the canon law."—Menage made these two verses upon his death:

Pinellus periit, Themidis pius ille sacerdos,
In proprio judex limine perpetuus.

PINEDA, JOHN, a writer of history, was born at Seville of a noble family, and entered into the society of Jesuits in 1572. He taught philosophy and divinity in several colleges; and devoted his time to the study of the Holy Scriptures. That he might render that study the easier, he made himself master of the oriental languages. We have of his writings, 1. Two volumes of Commentaries upon the book of Job, in folio. 2. Two upon Ecclesiastes. 3. A General History of the Church, in Spanish, 4 vol. in folio. 4. A History of Ferdinand III. in the same language, in folio. He died in 1637, much regretted by the members of his society, and by the public in general.

PINELLI, JOHN VINCENT, a distinguished literary character, was born at Naples, and was son of Count Pinelli, a noble Genoese, who had settled in that city, and had acquired a handsome fortune in the way of trade. After receiving a liberal education, he quitted the place of his nativity, and repaired to Padua, where he took up his residence at the age of 24. Being a great lover of science, he gave a preference to that city on account of its famous university, which brought to it a number of learned men. He had an excellent library, which consisted of a choice collection of books and manuscripts, and which he continued to enrich till the hour of his death. His literary correspondence, not only in Italy, but through the most of Europe, procured him all the new works which were worthy of a place in his collection. The authors themselves were often forward to pay their respects to him. In many cities of Italy he had persons employed to search, at least once a month, the stalls of those artificers who make use of old parchments, such as lute-makers, sievewrights, and others; and by this means he had the good fortune often to save from destruction some valuable fragments. His passion for knowledge embraced all the sciences; but history, medals, antiquities, natural history, and particularly botany, were his favourite studies. He was consulted from all quarters, and the extent of his acquaintance with the learned world was very great. He corresponded with Justus Lipsius, Joseph Scaliger, Sigonius, Possevin, Peter Pithou, and a great many others, who have all paid the highest compliments to his erudition. Insensible to all the pleasures of life, and acquainted only with those of the mind, he had a great dislike to plays, entertainments, shows, and every thing which most excites the curiosity of other men. During the space of 43 years that he lived at Padua, he was never known to be out of the city but twice; once on occasion of a plague which infested it; and afterwards on a voyage to Naples, which he made at the earnest solicitation of his friends. In short, Pinelli was generous,

ous, sympathizing, and compassionate, particularly to men of letters, whose wants he often anticipated. His zeal for the progress and advancement of science rendered him very communicative of his knowledge and of his books; but this was always done with judgment and discretion. He died in 1601, aged 68, without having published any work. Paul Gualdo, who has written Pinelli's life, does not specify the number of volumes of which his rich library consisted: he only informs us, that when it was transported by sea to Naples, it was packed up in 130 chests, of which 14 contained manuscripts; but it did not go wholly to his heirs. The senate of Venice caused their seal to be set upon the manuscripts, and took away whatever concerned the affairs of the republic, to the number of 200 pieces.—"I compare (says President de Thou) Pinelli to Titus Pomponius; for, as that illustrious Roman was called *Attick*, Pinelli also bore the title of *Venetian*, on account of the great affection which the republic of Venice had for him.

PINET, ANTONY DU, lord of Noroy, an ecclesiastical writer, who lived in the 16th century, and was a native of Besançon in France. He was strongly attached to the Protestant religion, and a bitter enemy to the church of Rome. His book, entitled *La Conformité des Eglises Reformés de France, et de l'Eglise primitive*, printed at Lyons, 1564, in 8vo; and the notes which he added to the French translation of the Fees of the Pope's Chancery, which was printed at Lyons, in 8vo, 1564, and reprinted at Amsterdam in 1700, in 12mo, plainly discover his sentiments. He published the last mentioned performance under this title: *Taxé des parties casuelles de la boutique du Pape*, in Latin and French, with some notes taken from decrees, councils, and canons, in order to ascertain the discipline anciently observed in the church. In the epistle dedicatory, he assumes the tone of a declared enemy to the court of Rome. He apologizes for having presented this book "to a society so holy as yours (the Protestants), in which are heard only hymns, psalms, and praises, to the Lord our God: but it is proper to show to the villain his villany, and the fool his folly, lest one should be thought to resemble them." We see by this specimen, that Pinet had no more politeness in his style than in his manners. His translation of Pliny's Natural History, printed at Lyons in 2 vols folio, 1566, and at Paris, 1608, was formerly much read. Though there are many errors in it, it is yet very useful, especially for those who do not understand Pliny's Latin, on account of the translators researches, and a great number of marginal notes. Pinet also published "Plans of the principal fortresses in the world," at Lyons, 1564, in folio.

Grosier's General Description of China, vol. i. p. 92.

PING-LEANG-FOU, a city of China in the province of Chen-si. It is one of the most considerable cities of the western part of the province, and is situated on the river Kin-ho. The air here is mild; and the agreeable views which the surrounding mountains present, added to the streams which water the country, render it a very delightful residence. It has under its jurisdiction three cities of the second class and seven of the third. In this district is a valley so deep and narrow, that it is almost impervious to the light: a large highway, paved with square stones, runs through it.

PINGUICULA, BUTTERWORT; a genus of plants belonging to the diandria class. See BOTANY *Index*.

PINGUIN, or PENGUIN, in *Ornithology*, a genus of birds of the order anseres. See APTENODYTES, ORNITHOLOGY *Index*, or page 507.

PINION, in *Mechanics*, an arbor, or spindle, in the body whereof are several notches, which catch the teeth of a wheel that serves to turn it round; or it is a lesser wheel that plays in the teeth of a larger.

PINK, a name given to a ship with a very narrow stern; whence all vessels, however small, whose sterns are fashioned in this manner, are called *pink-sterned*.

PINK. See DIANTHUS, BOTANY *Index*.

PINNA, in *Zoology*, a genus of shell-fish belonging to the order of vermes testacea. See CONCHOLOGY *Index*.—Pliny, who gives some account, perhaps not very correct, of the history of some of the species of this genus (lib. ix. 51.) says, the smallest of all the kinds is called the *pinnoteres*, and therefore liable to injury; this has the prudence to hide itself in the shells of oysters. Again, lib. ix. 66. he says, the pinna is of the genus of shell-fish; it is produced in muddy waters, always erect, nor ever without a companion, which some call the *pinnoteres*, others the *pinnophylax*. This sometimes is a small squill, sometimes a crab, that follows the pinna for the sake of food. The pinna, upon opening its shell, exposes itself as a prey to the smallest kind of fishes; for they immediately assault her, and, growing bolder upon finding no resistance, venture in. The guard, watching its time, gives notice by a bite; upon which the pinna, closing its shell, shuts in, kills, and gives part of whatever happens to be there to its companion.

> The pinna and the crab together dwell,
> For mutual succour, in one common shell.
> They both to gain a livelihood combine;
> That takes the prey, when this has given the sign.
> From hence this crab, above his fellows fam'd,
> By ancient Greeks was *pinnoteres* nam'd.—OPPIAN.

PINNACE, a small vessel navigated with oars and sails, and having generally two masts, which are rigged like those of a schooner.

PINNACE is also a boat usually rowed with eight oars. See the article BOAT.

PINNACLE, in *Architecture*, the top or roof of a house, terminating in a point. This kind of roof among the ancients was appropriated to temples; their ordinary roofs were all flat, or made in the platform way.

PINNATED LEAVES. See BOTANY *Index*.

PINNATIFID LEAVES. See BOTANY *Index*.

PINNOTERUS, or PINNOPHYLAX, is a kind of crab-fish, furnished with very good eyes. It is said to be the companion of the pinna marina. They live and lodge together in the same shell, which belongs to the latter. When it has occasion to eat, it opens its valves, and sends out its faithful purveyor to procure food. If during their labour the pinnoterus perceives the polypus, it immediately returns to warn its blind friend of the danger, when, by shutting its valves, it escapes the rage of its enemy; but when the pinnoterus loads itself with booty without molestation, it makes a gentle noise at the opening of the shell, and when admitted the two friends feast on the fruits of its industry. See PINNA, &c.

PINT *(pinta)*, a vessel or measure, used in estimating the quantity of liquids, and even sometimes of dry things.—Budæus derives the word from the Greek ϖινθα; others from the German *pint*, a little measure of wine; Nicod from the Greek ϖινειν, "to drink."

The *English pint* is twofold; the one for wine measure, the other for beer and ale measure. See MEASURE.

PINTADA, a species of PROCELLARIA.

PINTLES, certain points or hooks fastened upon the back part of the rudder, with their points downwards, in order to enter into, and rest upon, the *googings*, fixed in the stern-post, to hang the rudder. See HELM.

PINTOR, PETER, physician, was born at Valentia in Spain, in the year 1420, and was physician to Alexander VI. whom he followed to Rome, where he practised with great success. He has left behind him two performances of considerable merit, 1. *Aggregator Sententiarum Doctorum de Curatione in Pestilentia*, printted at Rome 1499, in folio. 2. *De Morbo Fœdo et Occulto his Temporibus Affligenti*, &c. printed at Rome, 1500, in 4to, black letter: a book extremely scarce, unknown to Luisini and Astruc, and which traces the venereal disease to the year 1496. Pintor died at Rome in 1503, aged 83 years.

PINTURICCIO, BERNARDINO, a celebrated Italian painter, was born at Perusia in 1454. He was the disciple of Peter Perugino, under whom he became so good an artist, that he employed him on many occasions as his assistant. He principally painted history and grotesque; but he also excelled in portraits, among which those of Pope Pius II. and Innocent VIII. of Giulia Farnese, Cæsar Borgia, and Queen Isabella of Spain, are particularly distinguished. The most memorable performance of Pinturiccio is the history of Pius II. painted in ten compartments in the monastery of Sienna; in which undertaking, Raphael, then a young man, and bred under the same master, assisted him so far as to sketch out cartoons of many parts of the composition. The story of his death is worth relating, especially as it illustrates his character. The last work he was engaged in was a *Nativity* for the monastery of St Francis at Sienna: the monks accommodated him with a chamber to work in, which they cleared of all the furniture, except one old trunk or chest that appeared too rotten to move; but Pinturiccio, naturally positive and peevish, insisted on its being taken away, and the monks, willing to gratify him, complied. It was no sooner stirred than one of the planks bursting, out tumbled 500 pieces of gold, which had been secreted there for many years. The monks were overjoyed at finding this treasure, and the painter proportionably mortified at losing his chance of the discovery by his indiscreet obstinacy: it affected his spirits so much that he survived but a few months, and it was generally considered as the cause of his death.

PINUS, the PINE-TREE; a genus of plants belonging to the monœcia class. See BOTANY *Index*. The pine-tree was well known to the ancients, and has been described and celebrated both by their philosophers and poets. Pliny enumerates no less than six species of trees of this genus; and it is mentioned by Virgil both in his Eclogues, his Georgics, and his Æneid; by Horace in his Odes; by Ovid in his Metamorphoses; by Statius; and by Catullus, &c. Macrobius relates an anecdote concerning the cones of pine-trees, which in common language were called *poma pinea*, "pine-apples." There lived in the Augustan age one Vatinius, who by some means had irritated the Roman people so much that they pelted him with stones. When he entertained them with gladiators, to save himself from such treatment for the future, he procured an edict from the ediles, that no person should throw any thing but apples in the amphitheatre. It accidentally happened that at this time Cascellius, eminent for his wit as well as knowledge of the law, was consulted on the question, whether a pine-apple (the cone of the pine) was legally included in the term *pomum*, "an apple?" It is an apple (said he) if you intend to fling it at Vatinius *. A decision by which the edict in his favour did not much mend his situation: for Martial represents it dangerous to come under this tree, because the cones in his time were of so great a size and weight, probably enlarged by cultivation for ages.

Nuces Pineæ.
Poma sumus Cybeles: procul hinc discede, viator,
Ne cadat in miserum nostra ruina caput †.

There are generally reckoned 14 species of this genus; of which the most remarkable are these following:

1. The *Pinea*, *pineaster*, or wild pine, grows naturally on the mountains in Italy and the south of France. It grows to the size of a large tree; the branches extend to a considerable distance; and while the trees are young, they are fully garnished with leaves, especially where they are not so close as to exclude the air from those within; but as they advance in age, the branches appear naked, and all those which are situated below become unsightly in a few years; for which reason they are now much less in esteem than formerly.

2. The *pinus pinea*, or stone pine, is a tall evergreen tree, native of Italy and Spain. It delights in a sandy loam, though like most others it will grow well in almost any land. Respecting the uses of this species, Hanbury tells us that "the kernels are eatable, and by many preferred to almonds. In Italy they are served up at table in their desserts.—They are exceeding[illegible]olesome, being good for coughs, colds, consumptions, &c. on which account only this tree deserves to be propagated." Hanbury continues: "It may be very proper here to take notice of a very great and dangerous mistake Mr Miller has committed, by saying, under his article of stone-pine, that seeds kept in the cones will be good, and grow if they are sown ten or twelve years after the cones have been gathered from the trees; whereas the seeds of this sort, whether kept in the cones or taken out, are never good after the first year; and though sometimes a few plants will come up from the seeds that are kept in the cones for two years before, yet this is but seldom; neither must a tenth part of a crop be expected. This caution is the more necessary, as several gentlemen who had cones, upon reading Mr Miller's book, and finding the seeds would take no damage when kept there, deferred the work for a season or two, when they thought they should have more conveniency either of men or ground for their purpose; and were afterwards wholly disappointed, no plants appearing.

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* Saturn. lib. ii cap. 6.

† Lib. xiii Ep. 25.

pearing, the seeds being by that time spoiled and worth nothing."

3. The *rubra*, commonly called the *Scots fir* or *pine*. It is common throughout Scotland, whence its name; though it is also found in most of the other countries of Europe. M. du Hamel, of the Royal Academy of Sciences, mentions his having received some seeds of it from St Domingo in the West Indies; and thence concludes, that it grows indifferently in the temperate, frigid, and torrid zones. The wood of this tree is the red or yellow deal, which is the most durable of any of the kinds yet known. The leaves of this tree are much shorter and broader than those of the former sort, of a grayish colour, growing two out of one sheath; the cones are small, pyramidal, and end in narrow points; they are of a light colour, and the seeds are small.

4. The *pinus picea*, or yew-leaved fir, is a tall evergreen, and a native of Scotland, Sweden, and Germany. This species includes the silver fir and the balm of Gilead fir. The first of these is a noble upright tree. Mr Marsham says, "The tallest trees I have seen were spruce and silver firs in the valleys in Switzerland. I saw several firs in the dockyards in Venice 40 yards long; and one of 39 yards was 18 inches diameter at the small end. I was told they came from Switzerland."

Treatise on Planting and Ornamental Gardening.

The branches are not very numerous, and the bark is smooth and delicate. The leaves grow singly on the branches, and their ends are slightly indented. Their upper surface is of a fine strong green colour, and their under has an ornament of two white lines running lengthwise on each side the midrib; on account of which silvery look this sort is called the *silver fir*. The cones are large, and grow erect; and, when the warm weather comes on, they soon shed their seeds; which should be a caution to all who wish to raise this plant, to gather the cones before that happens.

The balm of Gilead fir has of all the sorts been most coveted, on account of the great fragrance of its leaves; though this is not its only good property: for it is a very beautiful tree, naturally of an upright growth, and the branches are so ornamented with their balmy leaves, as to exceed any of the other sorts in beauty. The leaves, which are very closely set on the branches, are broad; and their ends are indented. Their upper surface, when healthy, is of a fine dark-green colour, and their under has white lines on each side the midrib, lengthwise, nearly like those of the silver fir. These leaves when bruised are very finely scented; and the buds, which swell in the autumn for the next year's shoot, are very ornamental all winter, being turgid, and of a fine brown colour: and from these also exudes a kind of fine turpentine, of the same kind of (though heightened) fragrancy. The tree being wounded in any part, emits plenty of this turpentine; and Hanbury says, "it is supposed by many to be the sort from whence the balm of Gilead is taken, which occasions this tree being so called. But this is a mistake; for the true balm of Gilead is taken from a kind of terebinthus: though I am informed, that what has been collected from this tree has been sent over to England from America (where it grows naturally), and often sold in the shops for the true sort."

The silver fir is very hardy, and will grow in any soil or situation, but always makes the greatest progress in rich loamy earth. The balm of Gilead fir must be planted in deep, rich, good earth; nor will it live long in any other. The soil may be a black mould, or of a sandy nature, if it be deep enough, and if the roots have room enough to strike freely.

5. The *pinus abies*, or European spruce fir, a native of the northern parts of Europe and of Asia, includes the Norway spruce and long-coned Cornish fir. The former of these is a tree of as much beauty while growing, as its timber is valuable when propagated on that account. Its growth is naturally like the silver, upright: and the height it will aspire to may be easily conceived, when we say that the white deal, so much coveted by the joiners, &c. is the wood of this tree; and it may perhaps satisfy the curious reader to know, that from this fir pitch is drawn. The leaves are of a dark-green colour; they stand singly on the branches, but the younger shoots are very closely garnished with them. They are very narrow; their ends are pointed; and they are possessed of such beauties as to excite admiration. The cones are eight or ten inches long, and hang downwards.

Ibid.

The better the soil is, the faster will the spruce fir grow, though it will thrive very well in most of our English lands. In strong loamy earth it makes a surprising progress; and it delights in fresh land of all sorts, which never has been worn out by ploughing, &c. though it be ever so poor. The long-coned Cornish fir differs scarcely in any respect from the Norway spruce, except that the leaves and the cones are larger.

6. The *pinus Canadensis*, American or Newfoundland spruce fir, a native of Canada, Pennsylvania, and other parts of North America, includes three varieties. The white Newfoundland spruce, the red Newfoundland spruce, and the black Newfoundland spruce. These however, differ so little, that one description is common to them all. They are of a genteel upright growth, though they do not shoot so freely or grow so fast with us as the Norway spruce. The leaves are of the same green, and garnish the branches in the same beautiful manner as those of that species; only they are narrower, shorter, and stand closer. The greatest difference is observable in the cones; for these are no more than about an inch in length, and the scales are closely placed. In the cones, indeed, consists the difference of these three sorts: those of the white species are of a very light brown colour; those of the red species more of a nut-brown or reddish colour; and those of the black species of a dark or blackish colour. Besides this, there is scarcely any material difference; though it is observable, that this trifling variation seems to be pretty constant in the plants raised from the like seeds. These sorts will often flower, and produce cones when only about five or six feet high; and indeed look then very beautiful: but this is a sign of weakness in the plant, which it does not often fairly get over.

7. The *pinus balsamea*, or hemlock fir, a native of Virginia and Canada, possesses as little beauty as any of the fir tribe; though, being rather scarce in proportion, it is deemed valuable. It is called by some the *yew-leaved fir*, from the resemblance of the leaves to those of the yew-tree. It is a tree of low growth, with but few branches; and these are long and slender, and spread abroad without order. The leaves do not garnish the

branches so plentifully as those of any other sort of fir. The cones are very small and rounded; they are about half an inch long; and the scales are loosely arranged. We receive these cones from America, by which we raise the plants; though this caution should be given to the planter, that this tree is fond of moist rich ground, and in such a kind of soil will make the greatest progress.

8. The *pinus orientalis*, or oriental fir, a native of the East, is a low but elegant tree. The leaves are very short, and nearly square. The fruit is exceeding small, and hangs downward; and the whole tree makes an agreeable variety with the other kinds.

9. The *strobus*, Lord Weymouth's pine, or North American white pine. This grows sometimes to the height of 100 feet and upwards, and is highly valued on account of its beauty. The bark of the tree is very smooth and delicate, especially when young; the leaves are long and slender, five growing out of one sheath; the branches are pretty closely garnished with them, and thus make a fine appearance. The cones are long, slender, and very loose, opening with the first warmth of the spring; so that if they are not gathered in winter, the scales open and let out the seeds. The wood of this sort is esteemed for making masts for ships. In Queen Anne's time there was a law made for the preservation of these trees, and for the encouragement of their growth in America. Within these last 50 years they have been propagated in Britain in considerable plenty.

With respect to the culture of this species, Mr Hanbury, after some more general directions, continues thus, "I have known gentlemen, who, in attempting to raise these trees, have seen the young plants go off without perceiving the cause; and the more watering and pains they have taken, have found the plants persist in this way more and more, to their great mortification and astonishment. In the spring following these plants should be pricked out in beds half a foot asunder each way; and here they may stand two years, when they may be either finally planted out, or removed into the nursery, at the distance of one foot asunder, and two feet in the rows. If care has been taken of them in the nursery, they may be removed at a considerable height with great assurance of success: for it is much easier to make this pine grow than any of the other sorts: so that where they are wanted for ornament in parks, open places, &c. a show of them may be made in a little time.

"The soil the Weymouth pine delights in most is a sandy loam; but it likes other soils of an inferior nature: and although it is not generally to be planted on all lands like the Scotch fir, yet I have seen it luxuriant and healthy, making strong shoots, on blue and red clays, and other sorts of strong ground. On stony and slaty ground, likewise, I have seen some very fine trees; so that I believe whoever is desirous of having plantations of this pine, need not be curious in the choice of his ground."

10. The *pinus tæda*, or swamp-pine, is a tall evergreen tree, a native of the swamps of Virginia and Canada. There are several varieties of this genus which Hanbury enumerates and describes: such as, 1st, The three-leaved American swamp-pine. 2d, The two-leaved American pine. 3d, The yellow American pine, the yellow tough pine, and the tough pine of the plains; among which there is but little variety. 4th, The bastard pine. 5th, The frankincense pine. And 6th, the dwarf pine.

"There are (continues our author) many other sorts of American pines, which we receive from thence with the like cant names of those of the above, which I have chosen to retain, as they will probably be continued to be sent over; and that the gardener receiving them as such may best know what to do with them. In many of those sorts I see at present no material difference; so am induced to think they are the same, sent over with different names. Some of the sorts above mentioned differ in very few respects; but I have chosen to mention them, as a person may be supplied with the seeds from Pennsylvania, Jersey, Virginia, Carolina, &c. where they all grow naturally: and having once obtained the seeds, and from them plants, they will become pleasing objects of his nicest observations."

11. The *pinus cedrus*, ranked by Tournefort and others under larix, famous for its duration, is that popularly called by us the *cedar of Lebanon*, by the ancients *cedrus magna* or the *great cedar;* also *cedrelate*, κεδρελατη; and sometimes the Phœnician or Syrian cedar, from the country where it grows in its greatest perfection. It is a coniferous evergreen, of the bigger sort, bearing large roundish cones of smooth scales, standing erect, the leaves being small, narrow, and thick set.—They sometimes counterfeit cedar, by dyeing wood of a reddish hue: but the smell discovers the cheat, that of true cedar being very aromatic. In some places, the wood of the cajou tree passes under the name of cedar, on account of its reddish colour and its aromatic smell which somewhat resemble that of santal. Cedar-wood is reputed almost immortal and incorruptible; a prerogative which it owes chiefly to its bitter taste, which the worms cannot endure. For this reason it was that the ancients used cedar tablets to write upon, especially for things of importance, as appears from that expression of Persius, *Et cedra digna locutus.* A juice was also drawn from cedar, with which they smeared their books and writings, or other matters, to preserve them from rotting; which is alluded to by Horace: by means of which it was, that Numa's books, written on papyrus, were preserved entire to the year 535, as we are informed by Pliny.

Solomon's temple, as well as his palace, were both of this wood. That prince gave King Hiram several cities for the cedars he had furnished him on these occasions. Cortes is said to have erected a palace at Mexico, in which were 7000 beams of cedar, most of them 120 feet long, and 12 in circumference, as we are informed by Herrera. Some tell us of a cedar felled in Cyprus 130 feet long, and 18 in diameter. It was used for the main-mast in the galley of King Demetrius. Le Bruyn assures us, that the two biggest he saw on Mount Lebanon, measured, one of them 57 palms, and the other 47, in circumference. In the temple of Apollo at Utica, there were cedar trees near 2000 years old; which yet were nothing to that beam in an oratory of Diana at Seguntum in Spain, said to have been brought thither 200 years before the destruction of Troy. Cedar is of so dry a nature, that it will not endure to be fastened with iron nails, from which it usually shrinks; so that they commonly fasten it with pins of the same wood.

“The statue (says Hanbury) of the great goddess at Ephesus was made of this material; and, if this tree abounded with us in great plenty, it might have a principal share in our most superb edifices. The effluvia constantly emitted from its wood are said to purify the air, and make rooms wholesome. Chapels and places set apart for religious duties, being wainscotted with this wood, inspire the worshippers with a more solemn awe. It is not obnoxious to worms; and emits an oil which will preserve cloth or books from worms or corruption. The saw-dust will preserve human bodies from putrefaction; and is therefore said to be plentifully used in the rites of embalming, where practised.”

It is remarkable that this tree is not to be found as a native in any other part of the world than Mount Libanus, as far as hath yet been discovered. What we find mentioned in Scripture of the lofty cedars can be nowise applicable to the common growth of this tree; since, from the experience we have of those now growing in England, as also from the testimony of several travellers who have visited those few remaining trees on Mount Libanus, they are not inclined to grow very lofty, but on the contrary extend their branches very far; to which the allusion made by the Psalmist agrees very well, when he is describing the flourishing state of a people, and says, “They shall spread their branches like the cedar-tree.”

Rauwolf, in his Travels, says, there were not at that time (i. e. anno 1574) upon Mount Libanus more than 26 trees remaining, 24 of which stood in a circle; and the other two, which stood at a small distance, had their branches almost consumed with age; nor could he find any younger tree coming up to succeed them, though he looked about diligently for some. These trees (he says) were growing at the foot of a small hill on the top of the mountains, and amongst the snow. These having very large branches, commonly bend the tree to one side, but are extended to a great length, and in so delicate and pleasant order, as if they were trimmed and made even with great diligence, by which they are easily distinguished, at a great distance, from fir-trees. The leaves (continues he) are very like to those of the larch tree, growing close together in little branches upon small brown shoots.

Maundrel, in his Travels, says, there were but 16 large trees remaining when he visited the mountain, some of which were of a prodigious bulk, but that there were many more young ones of a smaller size: he measured one of the largest, and found it to be 12 yards six inches in girth, and yet sound, and 37 yards in the spread of its boughs. At about five or six yards from the ground it was divided into five limbs, each of which was equal to a great tree. What Maundrel hath related was confirmed by a gentleman who was there in the year 1720, with this difference only, viz. in the dimensions of the branches of the largest tree, which he measured, and found to be 22 yards diameter. Now, whether Mr Maundrel meant 37 yards in circumference of the spreading branches, or the diameter of them, cannot be determined by his words; yet either of them well agrees with this last account.

12. There is another species, viz. the *larch tree*, which the old botanists ranked under larix, with deciduous leaves, and oval obtuse cones. It grows naturally upon the Alps and Apennines, and of late has been very much propagated in Britain. It is of quick growth, and the trunk rises to 50 feet or more; the branches are slender, their ends are generally hanging downward, and are garnished with long narrow leaves which arise in clusters from one point, spreading open above like the hair of a painter's brush: they are of a light green, and fall away in autumn. In the month of April the male flowers appear, which are disposed in form of small cones; the female flowers are collected into oval obtuse cones, which in some species have bright purple tops, and in others they are white: these differences are accidental; the cones are about an inch long, obtuse at their points; the scales are smooth, and lie over each other: under each scale there are generally lodged two seeds which have wings. There are other two varieties of this tree, one of which is a native of America, and the other of Siberia. The cones of the American kind which have been brought to Britain seem in general to be larger than those of the common sort.

“Many encomiums (says Hanbury when speaking of this species) have been bestowed on the timber of the larch: and we find such a favourable account of it in ancient authors, as should induce us to think it would be proper for almost any use. Evelyn recites a story of Witsen, a Dutch writer, that a ship built of this timber and cypress had been found in the Numidian sea, twelve fathoms under water, sound and entire, and reduced to such a hardness as to resist the sharpest tool, after it had lain submerged above 1400 years. Certain it is this is an excellent wood for ship and house-building. At Venice this wood is frequently used in building their houses, as well as in Switzerland, where these trees abound: so that, without all doubt, the larch excels for masts for ships, or beams for houses, doors, windows, &c. particularly as it is said to resist the worm.

“In Switzerland (A) their houses are covered with boards of this wood cut out a foot square; and, as it emits a resinous substance, it so diffuses itself into every joint and crevice, and becomes so compact and close, as well as so hardened by the air, as to render the covering proof against all weather. But as such covering for houses would cause great devastation in case of fire, the buildings

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(A) “Between Bex and Bevieux (says Coxe in his *Travels in Switzerland*), I observed the larch in great plenty. Painters, from the time of Pliny to that of Raphael, trusted their works to this wood, which the Roman naturalist stiles *immortale lignum*. The wood is reckoned excellent for all works which are to lie under water: and the borderers on the lake of Geneva prefer it for building their vessels. In these parts I saw most beautiful woods of chesnut. Haller says that they extend some leagues: he also informs us, that they are found in other parts of Switzerland, and even in desert places in some of the transalpine parts. Accident must have brought them thither, as it appears from Pliny that these trees were first introduced into Europe from Sardis.”

buildings are confined to a limited distance by an order of police from the magistrates. The wood, when first laid on the houses, is said to be very white; but this colour, in two or three years is changed, by means of the sun and resin, to a black, which appears like a smooth shining varnish."

Of the common larch there are several varieties. The flowers which the commonest sort exhibits early in the spring are of a delicate red colour; another sort produces white flowers at the same season, and these have a delightful effect among those of the red sort; whilst another, called the *Black Newfoundland larix*, increases the variety, though by an aspect little differing from the others. There are also larches with greenish flowers, pale red, &c. all of which are accidental varieties from seeds. These varieties are easily distinguished, even when out of blow: the young shoots of the white-flowering larch are of the lightest green, and the cones when ripe are nearly white. The red flowering larch has its shoots of a reddish cast, and the cones are of a brown colour; whilst the cones and shoots of the black Newfoundland larch are in the same manner proportionally tinged. The cones, which are a very great ornament to several sorts of the pines, are very little to these. Their chief beauty consists in the manner of their growth, the nature and beauty of their pencilled leaves and fair flowers; for the cones that succeed them are small, of a whitish, a reddish, or a blackish-brown colour, and make no figure.

The pinus cedrus and pinus larix are propagated by sowing in March on a bed of light earth exposed to the morning sun. The seed must be covered half an inch thick with fine light earth, and the beds watered at times when the weather is dry. In about six weeks the plants will appear; they must at this time be carefully guarded from the birds, shaded from the sun and winds, and kept very clear of weeds. In the latter end of April the following year, they may be removed into beds of fresh earth, placing them at ten inches distance every way. They are to be kept here two years, and such of them as seem to bend must be tied up to a stake to keep them upright. They may afterwards be planted in the places where they are to remain. They thrive well on the sides of barren hills, and make a very pretty figure there.

Respecting the uses of this tree, Dr Pallas, in his *Flora Rossica*, informs us, that if it is burnt, and the wood consumed, the internal part of the wood distils copiously a drying reddish gum, a little less glutinous than gum arabic, somewhat of a resinous taste, but wholly soluble in water. At the instigation of M. Kinder, this gum has lately been sold in the Russian shops under the name of *gummi Orenburgensis*, but which our author thinks should be called *gummi Uraliense* or *laricis*. It is eaten by the Woguli as a dainty, and is said to be nutritious and antiscorbutic. Some manna was gathered from the green leaves, but it could never be condensed. The Russians use the boletus laricinus as an emetic in intermittents, and to check the leucorrhœa. At Baschir and Siberia the inhabitants sprinkle the dry powder on the wounds of oxen and horses, as a detergent and anthelmintic. The nuts of the pinus cembra, the same author asserts, are eaten as luxuries in Russia, and are even exported with the same view. The unripe cones give a very fragrant oil, termed balsamic. The inhabitants of Siberia use the tender tops, and even the bark rubbed off in the spring, as an antiscorbutic. The kernels of the nuts of the amygdalus nana give a very pleasing flavour to brandy; and, when pressed, afford a bitter oil in large quantities. The way of destroying the bitter is by digesting it in the sun with spirit of wine, and it then becomes sweet and extremely agreeable.

From the larch-tree is extracted what is erroneously called *Venice turpentine*. This substance, or natural balsam, flows at first without incision; when it has done dropping, the poor people who wait in the fir woods make incisions at about two or three feet from the ground into the trunks of the trees, into which they fix narrow troughs about 20 inches long. The end of these troughs is hollowed like a ladle; and in the middle is a small hole bored for the turpentine to run into the receiver which is placed below it. As the gummy substance runs from the trees, it passes along the sloping gutter or trough to the ladle, and from thence runs through the holes into the receiver. The people who gather it visit the trees morning and evening from the end of May to September, to collect the turpentine out of the receivers. When it flows out of the tree, Venice turpentine is clear like water, and of a yellowish white; but as it grows older, it thickens and becomes of a citron colour. It is procured in the greatest abundance in the neighbourhood of Lyons, and in the valley of St Martin near Lucern in Switzerland.

Though we have already noticed the manner of cultivating some of the particular species of this genus, and have also remarked the uses of some of them, we shall finish the article with a few general observations on the culture and uses of the whole.

Culture. All the sorts of pines are propagated by seeds produced in hard woody cones. The way to get the seeds out of these cones is to lay them before a gentle fire, which will cause the cells to open, and then the seed may be easily taken out. If the cones are kept entire, the seeds will remain good for some years; so that the surest way of preserving them is to let them remain in the cones till the time for sowing the seeds. If the cones are kept in a warm place in summer, they will open and emit the seeds; but if they are not exposed to the heat, they will remain close for a long time. The best season for sowing the pines is about the end of March. When the seeds are sown, the place should be covered with nets to keep off the birds; otherwise, when the plants begin to appear with the husk of the seed on the top of them, the birds will peck off the tops, and thus destroy them.

Uses. From the first species is extracted the common turpentine, much used by farriers, and from which is drawn the oil of that name. The process of making pitch, tar, resin, and turpentine, from these trees is very familiar. In the spring time, when the sap is most free in running, they pare off the bark of the pine tree, to make the sap run down into a hole which they cut at the bottom to receive it. In the way, as it runs down, it leaves a white matter like cream, but a little thicker, This is very different from all the kinds of resin and turpentine in use, and it is generally sold to be used in the making of flambeaux instead of white bees wax. The matter that is received in the hole at the bottom is taken up with ladles, and put in a large basket. A great part of this immediately runs through, and this is the common turpentine. This is received into stone or earthen pots, and is ready for sale. The thicker matter, which remains in the basket, they put into a common alembic, adding a large quantity of water. They distil this as long as any oil is seen swimming upon the water. This oil they separate from the surface in large quantities, and this is the common oil or spirit of turpentine. The remaining matter at the bottom of the still is common yellow resin. When they have thus obtained all that they can from the sap of the tree, they cut it down, and hewing the wood into billets, they fill a pit dug in the earth with these billets, and setting them on fire, there runs from them, while they are burning, a black thick matter. This naturally falls to the bottom of the pit, and this is the tar. The top of the pit is covered with tiles, to keep in the heat; and there is at the bottom a little hole, out at which the tar runs like oil. If this hole be made too large, it sets the whole quantity of the tar on fire; but, if small enough, it runs quietly out.

The tar, being thus made, is put up in barrels; and if it be to be made into pitch, they put it into large boiling vessels, without adding any thing to it. It is then suffered to boil a while, and being then let out, is found when cold to be what we call pitch.

A decoction of the nuts or seeds of the first species in milk, or of the extremities of the branches pulled in spring, is said, with a proper regimen, to cure the most inveterate scurvy. The wood of this species is not valued; but that of the Scots pine is superior to any of the rest. It is observable of the Scots pine, that when planted in bogs, or in a moist soil, though the plants make great progress, yet the wood is white, soft, and little esteemed; but when planted in a dry soil, though the growth of the trees is there very slow, yet the wood is proportionably better. Few trees have been applied to more uses than this. The tallest and straightest are formed by nature for masts to our navy. The timber is resinous, durable, and applicable to numberless domestic purposes, such as flooring and wainscotting of rooms, making of beds, chests, tables, boxes, &c. From the trunk and branches of this, as well as most others of the pine tribe, tar and pitch are obtained. By incision, barras, Burgundy pitch, and turpentine, are acquired and prepared. The resinous roots are dug out of the ground in many parts of the Highlands, and, being divided into small splinters, are used by the inhabitants to burn, instead of candles.—At Loch-Broom, in Ross-shire, the fishermen make ropes of the inner bark; but hard necessity has taught the inhabitants of Sweden, Lapland, and Kamtschatka, to convert the same into bread. To effect this, they, in the spring season, make choice of the tallest and fairest trees; then stripping off carefully the outer bark, they collect the soft, white, succulent interior bark, and dry it in the shade. When they have occasion to use it, they first toast it at the fire, then grind, and after steeping the flour in warm water to take off the resinous taste, they make it into thin cakes, which are baked for use. On this strange food the poor inhabitants are sometimes constrained to live for a whole year; and, we are told, through custom, become at last even fond of it. Linnæus remarks, that this same bark-bread will fatten swine; and humanity obliges us to wish, that men might never be reduced to the necessity of robbing them of such a food. The interior bark, of which the above-mentioned bread is made, the Swedish boys frequently peel off the trees in the spring, and eat raw with greedy appetite. From the cones of this tree is prepared a diuretic oil, like the oil of turpentine, and a resinous extract, which has similar virtues with the balsam of Peru. An infusion or tea of the buds is highly commended as an antiscorbutic. The farina, or yellow powder, of the male-flowers, is sometimes in the spring carried away by the winds, in such quantities, where the trees abound, as to alarm the ignorant with the notion of its raining brimstone. The tree lives to a great age; Linnæus affirms to 400 years.

PIONEERS, in the art of war, are such as are commanded in from the country, to march with an army, for mending the ways, for working on intrenchments and fortifications, and for making mines and approaches. The soldiers are likewise employed for all these purposes. Most of the foreign regiments of artillery have half a company of pioneers, well instructed in that important branch of duty. Our regiments of infantry and cavalry have three or four pioneers each, provided with aprons, hatchets, saws, spades, and pick-axes. Each pioneer must have an axe, a saw, and an apron; a cap with a leather crown, and a black bears-skin front, on which is to be the king's crest in white, on a red ground; and the number of the regiment is to be on the back part of it.

PIP, or **Pep**, a disease among poultry, consisting of a white thin skin, or film, that grows under the tip of the tongue, and hinders their feeding. It usually arises from want of water, or from the drinking puddle-water, or eating filthy meat. It is cured by pulling off the film with the fingers, and rubbing the tongue with salt. Hawks are particularly liable to this disease, especially from feeding on stinking flesh.

PIPE, in building, &c. a canal, or conduit, for the conveyance of water and other liquids. Pipes for water, water-engines, &c. are usually of lead, iron, earth, or wood: the latter are usually made of oak or elder. Those of iron are cast in forges; their usual length is about two feet and a half: several of these are commonly fastened together by means of four screws at each end, with leather or old hat between them, to stop the water. Those of earth are made by the potters; these are fitted into one another, one end being always made wider than the other. To join them the closer, and prevent their breaking, they are covered with tow and pitch: their length is usually about that of the iron pipes. The wooden pipes are trees bored with large iron augres, of different sizes, beginning with a less, and then proceeding with a larger successively; the first being pointed, the rest being formed like spoons, increasing in diameter, from one to six inches and more: they are fitted into the extremities of each other (as represented fig. 2.), and are sold by the foot. Plate CCCCXIX. fig. 2.

Wooden pipes are bored as follows. The machine represented fig. 1. is put in motion by the wheel A, Fig. 1. which is moved by a current of water; upon the axle of this wheel is a cog-wheel B, which causes the lanterns C, D, to turn horizontally, whose common axis is consequently in a perpendicular direction. The lantern D turns at the same time two cog-wheels, E and F: the first, E, which is vertical, turns the augre which bores the wood; and the second F, which is horizontal, causes the carriage bearing the piece to advance by means of the arms H, I, which take hold of the notches.

ches in the wheel K. The first, H, by means of the notches, draws the wheel towards F; and the other, I, pushes the under-post of the wheel in an opposite direction; both which motions tend to draw the carriage towards F, and consequently cause the augre to pierce the wood. The augre being from 9 to 12 feet in length, and of a proportionable bigness, it will be necessary to have two pieces, as L, L, to support its weight, and cause it to enter the piece to be bored with the same uniformity.

For the construction of leaden pipes, see the article PLUMBERY.

Air-Pipes. See *Air-Pipes.*

Pipes of an Organ. See ORGAN.

Bag-Pipe. See *Bag-Pipe.*

Horn-Pipe. See HORNPIPE.

Tobacco-Pipe, a machine used in the smoking of tobacco, consisting of a long tube, made of earth or clay, having at one end a little case, or furnace, called the *bowl*, for the reception of the tobacco, the fumes whereof are drawn by the mouth through the other end. Tobacco pipes are made of various fashions; long, short, plain, worked, white, varnished, unvarnished, and of various colours, &c. The Turks use pipes three or four feet long, made of rushes, or of wood bored, at the end whereof they fix a kind of a pot of baked earth, which serves as a bowl, and which they take off after smoking.

PIPE, also denotes a vessel or measure for wine, and things measured by wine-measure. See BARREL and MEASURE.

PIPE, in *Mining*, is where the ore runs forwards endwise in a hole, and doth not sink downwards or in a vein.

PIPE, *Pipa*, in *Law*, is a roll in the exchequer, called also the *great roll*. See the next article.

Pipe-Office, is an office wherein a person called the *clerk of the pipe*, makes out leases of crown-lands, by warrant from the lord-treasurer, or commissioners of the treasury, or chancellor of the exchequer. The clerk of the pipe makes out also all accounts of sheriffs, &c. and gives the accountants their *quietus est.* To this office are brought all accounts which pass the remembrancer's office, and remain there, that if any stated debt be due from any person, the same may be drawn down into the great roll of the pipe: upon which the comptroller issues out a writ, called the *summons of the pipe*, for recovery thereof; and if there be no goods or chattels, the clerk then draws down the debts to the lord treasurer's remembrancer, to write estreats against their lands. All tallies which vouch the payment of any sum contained in such accounts are examined and allowed by the chief secondary of the pipe. Besides the chief clerk in this office, there are eight attorneys or sworn clerks, and a comptroller.

Pipe-Fish. See SYNGNATHUS, ICHTHYOLOGY *Index.*

Sea Pipes, the trivial name of univalve shells belonging to the genus *dentalis.* See CONCHOLOGY *Index.*

PIPER, a species of fish. See TRIGLA, ICHTHYOLOGY *Index.*

PIPER, *Pepper;* a genus of plants belonging to the diandria class. See BOTANY *Index.* There are 20 species, of which the most remarkable is the siriboa, with oval, heart-shaped, nerved leaves, and reflexed spikes. This is the plant which produces the pepper so much used in food. It is a shrub whose root is small, fibrous, and flexible; it rises into a stem, which requires a tree or prop to support it. Its wood has the same sort of knots as the vine; and when it is dry, it exactly resembles the vine-branch. The leaves, which have a strong smell and a pungent taste, are of an oval shape; but they diminish towards the extremity, and terminate in a point. From the flower-buds, which are white, and are sometimes placed in the middle and sometimes at the extremity of the branches, are produced small berries resembling those of the currant tree. Each of these contains between 20 and 30 corns of pepper; they are commonly gathered in October, and exposed to the sun seven or eight days. The fruit which was green at first, and afterwards red, when stripped of its covering assumes the appearance it has when we see it. The largest, heaviest, and least shrivelled, is the best.

The pepper plant flourishes in the islands of Java, Sumatra (A), and Ceylon, and more particularly on the Malabar coast. It is not sown, but planted; and great nicety is required in the choice of the shoots. It produces no fruit till the end of three years; but bears so plentifully the three succeeding years, that some plants yield between six and seven pounds of pepper. The bark then begins to shrink; and the shrub declines so fast, that in 12 years time it ceases bearing.

The culture of pepper is not difficult: it is sufficient to plant it in a rich soil, and carefully to pull up the weeds that grow in great abundance round its roots, especially the three first years. As the sun is highly necessary to the growth of the pepper plant, when it is ready to bear, the trees that support it must be lopped to prevent their shade from injuring the fruit. When the season is over, it is proper to crop the head of the plant. Without this precaution, there would be too much wood, and little fruit.

The pepper exported from Malabar, which was formerly entirely in the hands of the Portuguese, and was afterwards divided between the Dutch, British, and French, amounted to about 10,000,000 weight. Betel, or betle, is a species of this genus. See BETEL. It is a creeping and climbing plant like the ivy; and its leaves a good deal resemble those of the citron, though they are longer and narrower at the extremity. It grows in all parts of India, but thrives best in moist places. The natives cultivate it as we do the vine, placing props for it to run and climb upon; and it is a common practice to plant it against the tree which bears the areca-nut.

At all times of the day, and even in the night, the Indians chew the leaves of the betel, the bitterness of which is corrected by the areca that is wrapped up in them. There is constantly mixed with it the chinam, a

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(A) See a copious account of the mode of cultivating pepper in Sumatra, in Mr Marsden's *History of Sumatra*, or in the *New Annual Register* for 1783, p. 147.

a kind of burnt lime made of shells. The rich frequently add perfumes, either to gratify their vanity or their sensuality.

It would be thought a breach of politeness among the Indians to take leave for any long time, without presenting each other with a purse of betel. It is a pledge of friendship that relieves the pain of absence. No one dares to speak to a superior unless his mouth is perfumed with betel; it would even be rude to neglect this precaution with an equal. The women of gallantry are the most lavish in the use of betel, as being a powerful incentive to love. Betel is taken after meals; it is chewed during a visit; it is offered when you meet, and when you separate; in short, nothing is to be done without betel. If it is prejudicial to the teeth, it assists and strengthens the stomach. At least, it is a general fashion that prevails throughout India.

London Medical Journal, vol. viii. part iii p. 276, &c.

The *piper amalago*, or black pepper, and the *piper inequale*, or long pepper of Jamaica, with some other species, are indigenous, and known by the names of *joint wood*, or *peppery elders*. The first bears a small spike, on which are attached a number of small seeds of the size of mustard. The whole of the plant has the exact taste of the East India black pepper. The long pepper bush grows taller than the amalago. The leaves are broad, smooth, and shining. The fruit is similar to the long pepper of the shops, but smaller. The common people in Jamaica season their messes with the black pepper. To preserve both, the fruit may be slightly scalded when green, then dried, and wrapped in paper. Perhaps hereafter they may be deemed worthy of attention.

PIPRA, a genus of birds, of the order of *passeres*. See ORNITHOLOGY *Index*.

PIQUET, or PICKET, a celebrated game at cards, much in use throughout the polite world.

It is played between two persons, with only 32 cards; all the deuces, threes, fours, fives, and sixes, being set aside.

In reckoning at this game, every card goes for the number it bears, as a ten for ten; only all court cards go for ten, and the ace for eleven: and the usual game is one hundred up. In playing, the ace wins the king, the king the queen, and so down.

Twelve cards are dealt round, usually by two and two; which done, the remainder are laid in the middle: if one of the gamesters finds he has not a court card in his hand, he is to declare he has *carte-blanche*, and tell how many cards he will lay out, and desire the other to discard, that he may show his game, and satisfy his antagonist that the carte-blanche is real; for which he reckons ten.

Each person discards, i. e. lays aside a certain number of his cards, and takes in a like number from the stock. The first of the eight cards may take three, four, or five; the dealer all the remainder, if he pleases.

After discarding, the eldest hand examines what suit he has most cards of; and reckoning how many points he has in that suit, if the other have not so many in that or any other suit, he tells one for every ten of that suit. He who thus reckons most is said to win the point.

The point being over, each examines what *sequences* he has of the same suit, viz. how many tierces, or sequences of threes, quartes or fours, quintes or fives, sixiemes, or sixes, &c. For a tierce they reckon three points, for a quarte four, for a quinte 15, for a sixieme 16, &c. And the several sequences are distinguished in dignity by the cards they begin from: thus ace, king, and queen, are called *tierce major;* king, queen, and knave, *tierce to a king;* knave, ten, and nine, *tierce to a knave*, &c. and the best tierce, quarte, or quinte, i. e. that which takes its descent from the best card, prevails, so as to make all the others in that hand good, and destroy all those in the other hand. In like manner, a quarte in one hand sets aside a tierce in the other.

The sequences over, they proceed to examine how many aces, kings, queens, knaves, and tens, each holds; reckoning for every three of any sort, three: but here too, as in sequences, he that with the same number of threes has one that is higher than any the other has, e. gr. three aces, has all his others made good hereby, and his adversary's all set aside. But four of any sort, which is called a *quatorze*, always sets aside three.

All the game in hand being thus reckoned, the eldest proceeds to play, reckoning one for every card he plays above a nine, and the other follows him in the suit; and the highest card of the suit wins the trick. Note, unless a trick be won with a card above a nine (except the last trick), nothing is reckoned for it, though the trick serves afterwards towards winning the cards; and that he who plays last does not reckon for his cards unless he wins the trick.

The cards being played out, he that has most tricks reckons ten for winning the cards. If they have tricks alike, neither reckons any thing. The deal being finished, and each having marked up his game, they proceed to deal again as before, cutting afresh each time for the deal.

If both parties be within a few points of being up, the carte-blanche is the first thing that reckons, then the point, then the sequences, then the quatorzes or threes, then the tenth cards.

He that can reckon 30 in hand by carte-blanche, points, quintes, &c. without playing, before the other has reckoned any thing, reckons 90 for them; and this is called a *repique*. If he reckons above 30, he reckons so many above 90. If he can make up 30, part in hand and part play, ere the other has told any thing, he reckons for them 60. And this is called a *pique*. Whence the name of the game. He that wins all the tricks, instead of ten, which is his right for winning the cards, reckons 40. And this is called a *capot*.

Mr de Moivre, who has made this game the object of mathematical investigation, has proposed and solved the following problems: 1. To find at piquet the probability which the dealer has for taking one ace or more in three cards, he having none in his hand. He concludes from his computation, that it is 29 to 28 that the dealer takes one ace or more. 2. To find at piquet the probability which the eldest has of taking an ace or more in five cards, he having no ace in his hand. Answer: 232 to 91, or 5 to 2, nearly. 3. To find at piquet the probability which the eldest hand has of taking an ace and a king in five cards, he having none in his hand. Answer: the odds against the eldest hand taking an ace and a king are 331 to 315, or 21 to 20 nearly. 4. To find at piquet the probability of having 12 cards dealt to, without king, queen, or knaves, which case is commonly called *cartes blanches*. Answer; the odds against cartes-blanches are 1791 to 1 nearly. 5. To find how many different sets, essentially different from one another, one may have at piquet before taking in. Answer; 28,967,278. This number falls short of the sum of all the distinct combinations, whereby 12 cards may be taken out of 32, this number being 225,792,840; but it must be considered that in that number several sets of the same import, but differing in suit, might be taken, which would not introduce an essential difference among the sets. The same author gives also some observations on this game, which he had from an experienced player. See *Doctrine of Chances*, p. 179, &c. M. de Monmort has treated of piquet in his *Analyse des Jeux de Hazard*, p. 162.

PIRA, is a name by which a variety of foreign fishes are distinguished. The *pira aca* is a little horned fish of the West Indies, called by Clusius and others the *monoceros* or *unicorn-fish*. The *pira acangata* is the name of a Brasilian fish, which resembles the perch both in size and shape. It seldom exceeds four or five inches in length; its mouth is small; its tail forked. On the back it has only one long fin, which is supported by rigid and prickly spines. This fin it can depress at pleasure, and sink within a cavity made for it in the back. Its scales are of a silvery white colour; it is wholesome and well tasted. *Pira bebe* is the name of the milvus, or kite-fish. *Pira coaba* is an American fish of the truttaceous kind, of a very delicate flavour. It grows to the length of 12 inches; its nose is pointed, and its mouth large, but without teeth; the upper jaw is longer than the under one, and hangs over like a cartilaginous prominence; its eyes are very large, and its tail is forked; under each of the gill fins there is a beard made of six white filaments, and covered with silvery scales. *Pira jurumenbeca* is a Brasilian fish otherwise called *bocca molle*. It lives in the muddy bottom of the American seas, and is a long-bodied not flatted fish. It grows to a great size, being found nine, and sometimes even ten or eleven, feet long, and two feet and a half thick. It has one long fin on the back, the anterior part of which is thin and pellucid. There is also a cavity on the back, as in the pira acangata, into which the fin can be depressed at pleasure; the tail is not forked, and the scales are all of a silvery colour and brightness. The fish is very well tasted; the *pira pixanga* is another Brasilian fish of the turdus or wrasse kind, and called by some the *gutvisch*. It is generally about four or five inches long; its mouth is pretty large, and furnished with very small and very sharp teeth; its head is small, but its eyes are large and prominent, the pupil being of a fine turquoise colour, and the iris yellow and red in a variety of shades. The coverings of the gills end in a triangular figure, and are terminated by a short spine or prickle; its scales are very small, and so evenly arranged, and closely laid on the flesh, that it is very smooth to the touch; its tail is rounded at the end; its whole body, head, tail, and fins, are of a pale yellow colour, variegated all over with very beautiful blood-coloured spots; these are round, and of the bigness of hemp-seed on the back and sides, and something larger on the belly; the fins are all spotted in the same manner, and are all marked with an edge of red. It is caught among the rocks, and about the shores, and is a very well tasted fish. *Piranha* is an American fish, more generally known by the name *piraya*. *Piraquiba*, or *ipiraquiba*, is the name of a fish originally Brasilian, which some writers apply to the *remora* or *sucking fish*.

PIRÆUS PORTUS, in *Ancient Geography*, a celebrated port to the west of Athens, consisting naturally of three harbours or basons, (Thucydides); which lay neglected, till Themistocles put the Athenians on making it a commodious port, (Nepos); the Phalerus, a small port, and not far from the city, being what they used before that time, (Pausanias, Nepos). Piræus was originally a village of Attica, (Pausanias); an island (Strabo); and though distant 40 stadia from Athens, was joined to it by two long walls, (Thucydides), and itself locked or walled round, (Nepos:) A very commodious and safe harbour. The whole of its compass was 60 stadia, including the Munichia. Not far from the Piræus stood the sepulchre of Themistocles; whither his friends conveyed his bones from Magnesia, into the Hither Asia, (Cicero, Plutarch, Pausanias). The entrance of the Piræus is narrow, and formed by two rocky points, one belonging to the promontory of Eetion, the other to that of Alcimus. Within were three stations for shipping; Kantharus, so named from a hero; Aphrodisium, from a temple of Venus; and Zea, the resort of vessels laden with grain. By it was a demos or borough town of the same name before the time of Themistocles, who recommended the exchanging its triple harbour for the single one of Phalerum, both as more capacious and as better situated for navigators. The wall was begun by him when archon, in the second year of the 75th Olympiad, 477 years before Christ; and afterwards he urged the Athenians to complete it as the importance of the place deserved. This whole fortification was of hewn stone, without cement or other material, except lead and iron, which were used to hold together the exterior ranges or facings. It was so wide that loaded carts could pass on it in different directions, and it was 40 cubits high, which was about half what he had designed.

Chandler's Travels in Greece, p. 14, &c.

The Piræus, as Athens flourished, became the common emporium of all Greece. Hippodamus an architect, celebrated, besides other monuments of his genius, as the inventor of many improvements in house-building, was employed to lay out the ground. Five porticoes, which uniting formed the *Long Portico*, were erected by the ports. Here was an *agora*, or market-place, and farther from the sea, another called *Hippodamia*. By the vessels were dwellings for the mariners. A theatre was opened, temples were raised, and the Piræus, which surpassed the city in utility, began to equal it in dignity. The cavities and windings of Municia, natural and artificial, were filled with houses; and the whole settlement, comprehending Phalerum and the ports of the Piræus, with the arsenals, the storehouses, the famous armoury of which Philo was the architect, and the sheds for 300, and afterwards 400, triremes, resembled the city of Rhodes, which had been planned by the same Hippodamus. The ports, on the commencement of the Peloponnesian,

Peloponnesian war, were secured with chains. Centinels were stationed, and the Piræus was carefully guarded.

The Piræus was reduced with great difficulty by Sylla, who demolished the walls, and set fire to the armoury and arsenals. In the civil war it was in a defenceless condition. Calenus, lieutenant to Cæsar, seized it, invested Athens, and ravaged the territory. Strabo, who lived under the emperors Augustus and Tiberius, observes, that the many wars had destroyed the long walls, with the fortress of Munychia, and had contracted the Piræus into a small settlement by the ports and the temple of Jupiter Saviour. This fabric was then adorned with wonderful pictures, the works of illustrious artists, and on the outside with statues. In the second century, besides houses for triremes, the temple of Jupiter and Minerva remained, with their images in brass, and a temple of Venus, a portico, and the tomb of Themistocles.

The port of the Piræus has been named *Porto Lione*, from the marble lion seen in the chart, and also *Porto Dracco*. The lion has been described as a piece of admirable sculpture, 10 feet high, and as reposing on its hinder parts. It was pierced, and, as some have conjectured, had belonged to a fountain. Near Athens, in the way to Eleusis, was another, the posture couchant; probably its companion. Both these were removed to Venice by the famous general Morosini, and are to be seen there before the arsenal. At the mouth of the port are two ruined piers. A few vessels, mostly small craft, frequent it. Some low land at the head seems an introachment on the water. The buildings are a mean customhouse, with a few sheds; and by the shore on the east side, a warehouse belonging to the French, and a Greek monastery dedicated to St Spiridion. On the opposite side is a rocky ridge, on which are remnants of the ancient wall, and of a gateway towards Athens. By the water edge are vestiges of building; and going from the customhouse to the city on the right hand, traces of a small theatre in the side of the hill of Munychia.

PIRACY, the crime of robbery and depredation upon the high seas.

By the ancient common law, piracy, if committed by a subject, was held to be a species of treason, being contrary to his natural allegiance; and by an alien, to be felony only: but now, since the statute of treasons, 25 Edw. III. c. 2. it is held to be only felony in a subject. Formerly it was only cognizable by the admiralty courts, which proceed by the rules of the civil law. But, it being inconsistent with the liberties of the nation, that any man's life should be taken away, unless by the judgment of his peers, or the common law of the land, the statute 28 Hen. VIII. c. 15. established a new jurisdiction for this purpose; which proceeds according to the course of the common law.

The offence of piracy, by common law, consists in committing those acts of robbery and depredation upon the high seas, which, if committed upon land, would have amounted to felony there. But, by statute, some other offences are made piracy also: as, by statute 11 and 12 W. III. c. 7. if any natural born subject commits any act of hostility upon the high seas, against others of his majesty's subjects, under colour of a commission from any foreign power; this, though it would only be an act of war in an alien, shall be construed piracy in a subject. And farther, any commander, or other seafaring person, betraying his trust, and running away with any ship, boat, ordnance, ammunition, or goods; or yielding them up voluntarily to a pirate; or conspiring to do these acts; or any person assaulting the commander of a vessel, to hinder him from fighting in defence of his ship; or confining him, or causing or endeavouring to cause a revolt on board; shall, for each of these offences, be adjudged a pirate, felon, and robber, and shall suffer death, whether he be principal, or merely accessory by setting forth such pirates, or abetting them before the fact, or receiving or concealing them or their goods after it. And the statute 4 Geo. I. c. 11. expressly excludes the principals from the benefit of clergy. By the statute 8 Geo. I. c. 24. the trading with known pirates, or furnishing them with ammunition, or fitting out any vessel for that purpose, or in any wise consulting, combining, confederating, or corresponding with them; or the forcibly boarding any merchant vessel, though without seizing or carrying her off, and destroying or throwing any of the goods overboard; shall be deemed piracy: and such accessories to piracy as are described by the statute of King William are declared to be principal pirates; and all pirates convicted by virtue of this act are made felons without benefit of clergy. By the same statutes also, (to encourage the defence of merchant-vessels against pirates), the commanders or seamen wounded, and the widows of such seamen as are slain, in any piratical engagement, shall be entitled to a bounty to be divided among them, not exceeding one-fiftieth part of the value of the cargo on board: and such wounded seamen shall be entitled to the pension of Greenwich hospital; which no other seamen are, except only such as have served in a ship of war. And if the commander shall behave cowardly, by not defending the ship, if she carry guns or arms; or shall discharge the mariners from fighting, so that the ship falls into the hands of pirates; such commander shall forfeit all his wages, and suffer six months imprisonment. Lastly, by statute 18 Geo. II. c. 30. any natural-born subject or denizen, who in time of war shall commit hostilities at sea against any of his fellow-subjects, or shall assist an enemy on that element, is liable to be tried and convicted as a pirate.

PIRATE, (πειρατης, Gr.); a sea-robber, or an armed ship that roams the seas without any legal commission, and seizes or plunders every vessel she meets indiscriminately, whether friends or enemies.

The colours usually displayed by pirates are said to be a black field, with a death's head, a battle-axe, and hour-glass. The last instrument is generally supposed to determine the time allowed to the prisoners, whom they take, to consider whether they will join the pirates in their felonious combination, or be put to death, which is often perpetrated in the most cruel manner.

Among the most celebrated pirates of the north is recorded Alvilda, daughter of a king of the Goths named *Syparaus*. She embraced this occupation to deliver herself from the violence imposed on her inclination, by a marriage with Alf, son of Sigarus king of Denmark. She dressed herself as a man; and composed her band of rowers, and the rest of her crew, of a number of young women attired in the same manner. Among the first of her cruizes, she touched at a place where a company of pirates bewailed the death of their captain. The strangers were captivated with the agreeable maners of Alvilda, and chose her for their chief. By this reinforcement she became so formidable upon the sea, that Prince Alf came to engage her. She sustained his attacks for a considerable time; but in a vigorous action, Alf boarded her vessel, and having killed the greatest part of her crew, seized the captain, namely herself; whom nevertheless he knew not, because the princess had a casque which covered her visage. Being master of her person, he removed the casque; and in spite of her disguise, instantly recognized her, and offered her his hand in wedlock.

PIRENE, (Pliny); a fountain sacred to the muses, springing below the top of the Acrocorinthus, a high and steep mountain which hangs over Corinth. Its waters were agreeable to drink, (Pausanias); extremely clear, (Strabo); very light, (Athenæus); and pale, (Persius): having relation either to the grief of Pirene, mother of Cenchrea, from whose tears this fountain arose, (Pausanias); or to the paleness brought on by the too eager pursuits of the muses.

PIROMALLI, Paul, a dominican of Calabria, was sent a missionary into the east. He remained a long time in Armenia, where he had the happiness to bring back to the church many schismatics and Eutycheans, and the patriarch himself who had before thrown every obstacle in his way. He afterwards passed into Georgia and Persia, then into Poland, in quality of Pope Urban VIII.'s nuncio, in order to appease the disturbances which had been occasioned there by the disputes of the Armenians, who were very numerous in that country. Piromalli united them in the profession of the same faith, and observance of the same ceremonies. In his return to Italy he was taken by some corsairs who carried him prisoner to Tunis. As soon as he was ransomed he went to Rome, and gave an account of his mission to the pope, who conferred upon him some signal marks of his esteem. His holiness entrusted him with the revisal of an Armenian bible, and sent him again into the east, where he was promoted, in 1655, to the bishopric of Nassivan. After having governed that church for nine years, he returned to Italy, and took the charge of the church of Bassignano, where he died three years after in 1667. His charity, his zeal, and other virtues, did honour to the episcopal office. There are extant of his writings, 1. Some works of Controversy and Theology. 2. Two Dictionaries; the one a Latin-Persian, and the other an Armenian Latin. 3. An Armenian Grammar. 4. A Directory, which is of great use in correcting Armenian books. All these works equally distinguish him for virtue and for learning.

PIRON, Alexis, a French poet, was born at Dijon in July 1689, where his father was an apothecary, and where he passed more than 30 years in idle and destructive dissipation. He was at length obliged to quit the place of his nativity, in order to avoid the reproaches of his fellow-citizens, on account of an ode which he had written, and which gave great offence. His relations not being able to give him much assistance, he supported himself at Paris by means of his pen, the strokes of which were as beautiful and fair as those of an engraver. He lived in the house of M. de Belleisle as his secretary, and afterwards with a financier, who did not know that he had a man of genius under his roof. His reputation as a writer commenced with some pieces which he published for the entertainment of the populace, and which showed strong marks of original invention; but what fully established his character in this way was his comedy intitled *Metromany*, which was the best that had appeared in France since Regnard's Gamester. This performance, in five acts, well conducted, replete with genius, wit, and humour, was acted with the greatest success upon the French stage in 1738. The author met with every attention in the capital which was due to a man of real genius, and whose flashes of wit were inexhaustible. We shall insert a few anecdotes of him, which will serve to show his character and turn of mind. In Burgundy the inhabitants of Beaune are called the *Asses of Beaune*. Piron often indulged his satirical disposition at their expence. One day as he was taking a walk in the neighbourhood of that city, he diverted himself with cutting down all the thistles which he met with. When a friend asked him his reason for doing so, he replied, *J'ai à me plaindre des Beaunois; je leur coupe les vivres*, i. e. "I am sorry indeed for the Beaunians; for I am cutting down their food." Being told again that these people would certainly be revenged of him,

> *Allez*, (says he) *Allez: je ne crains point leur impuissant couroux;*
> *Et quand je serois seul, je les batterois tous.*

"Get you gone, get you gone: I fear not their feeble revenge; for though alone, I shall beat them all." Going into a theatre one time where a play was acting, he asked what it was? The Cheats of Scapin, gravely replied a young Beaunian. "Ah! Sir, (says Piron, after thanking him), I took it to be the Cheats of Orestes." In the time of the play, some body addresses the company with "Silence there, gentlemen, we don't hear." "It is not at least (cried Piron) for want of ears." A bishop one day asked Piron, during the disputes about Jansenism, "Did you read my mandate, Mr Piron?" No, my lord; and you——The conversation turning very warm, the bishop reminded him of the distance which birth and rank had put between them. "Sir (says Piron), I have plainly the superiority over you at this moment; for I am in the right, and you are in the wrong."—Voltaire's Semiramis did not meet with a very favourable reception the first time it was acted. The author finding Piron behind the scenes, asked him what he thought of his performance? "I think (replied he) you would have been pleased that I had been the author of it." The performer of the character Ferdinand Cortez (the title of one of Piron's tragedies) having requested some corrections to be made on the play the first time it was acted, Piron fired at the word *corrections*. The player, who was deputed to wait upon the author with this request, cited the example of Voltaire, who corrected some of his pieces in order to gratify the taste of the public. "The cases are widely different (replied Piron); Voltaire works in chequer-work, and I cast in brass." If this answer be not very modest, we must allow that it does not want wit. He thought himself, if not superior, at least equal to Voltaire. Some person congratulating him on having composed the best comedy of this age, he answered, with more frankness than modesty, "Add too, and the best tragedy."

gedy." The following verses are well known, in which he says:

> *En deux mots voulez-vous distinguer et connoitre*
> *Le rimeur Dijonnois et le Parisien?*
> *Le premier ne fut rien, et ne voulut rien etre;*
> *L'autre voulut tout etre, et ne fut presque rien.*

We see by these different traits that Piron had a sufficient stock of self-conceit. What helped to increase it, and make him fancy himself superior to the most celebrated of his contemporaries, was, that his company, on account of his original humour, of which he had an uncommon share, was more courted than that of Voltaire, who was otherwise too lively, too captious, and crabbed. But those who have favoured us with an account of his many witticisms in conversation, would have done more honour to his memory if they had passed over such as were either indecent or insipid. A thing often pleases over a glass of wine, which will not give the same satisfaction when it is repeated, especially if, in repeating it, you want to make it appear of some importance. Be that as it may, Piron's mischievous ingenuity was partly the cause which excluded him from the French Academy.—"I could not (said he) make thirty-nine people think as I do, and I could less think as thirty-nine do." He called that celebrated society very unjustly *les invalides du bel esprit*, "the invalids of wit;" and yet he often endeavoured to be one of those invalids. His death was hastened by a fall which he got a little before. He died the 21st of January 1773, at the age of 83. He had prepared for himself the following epitaph, in the way of an epigram:

> *Ci gît Piron, qui ne fut rien,*
> *Pas même académicien.*

"Here lies Piron, who was nothing, not even an academician."

His wife Maria Theresa Quenandon, who died in 1751, he describes as a sweet and most agreeable companion. They lived together for several years; and no husband ever discharged his duty with more fidelity and attention.

A collection of his works appeared in 1776, in 7 vols. 8vo, and 9 vols. 12mo. The principal pieces, are, The School of Fathers; a comedy acted in 1728 under the title of Ungrateful Sons. Callisthenes; a tragedy, the subject of which is taken from Justin. The Mysterious Lover, a comedy. Gustavus and Ferdinand Cortez, two tragedies; some scenes of which discover an original genius, but the versification neither pleases the ear nor affects the heart. Metromany, a comedy. The Courses of Tempe, an ingenious pastoral, in which the manners both of the town and country are pleasantly drawn. Some odes, poems, fables, and epigrams. In this last kind of poetry he was very successful, and he may be placed after Marot and Rousseau. There was no occasion for loading the public with 7 vols of his works; the half of that number might have sufficed. For, excepting Metromany, Gustavus, the Courses of Tempe, some odes, about 20 epigrams, three or four fables, and some epistles, the rest are but indifferent, and have no claim to any extraordinary merit.

PISA, a large town of Tuscany in Italy, situated on the river Arno, 52 miles from Florence. It was a famous republic, till subdued, first by the duke of Milan, and then by the Florentines in the year 1406. Before it lost its freedom, it is said to have contained near 150,000 inhabitants, but now it has not above 16,000 or 17,000. It was founded we are told by the Pisans of Peloponnesus, and afterwards become one of the 12 municipia of Tuscany. Its neighbourhood to Leghorn, which is now the chief port in the Mediterranean, though formerly of little or no note for trade, has contributed greatly to the decay of Pisa, which, however, begins to lift up its head again, under the auspices of the present grand duke, who has made it his winter residence. Between Pisa and Leghorn is a canal 16 Italian miles in length.—Its territory is very fruitful; abounding in corn, wine, and fruit, and fine cattle. The houses are well built, and the streets even, broad, and well paved; but in many places overrun with grass. The university is well endowed, and has able professors, but is not in a very flourishing condition. The exchange is a stately structure, but little frequented. The grand duke's galleys are built, and commonly stationed here. This city is also the principal residence of the order of St Stephen, and the see of an archbishop. The cathedral, a large Gothic pile, contains a great number of excellent paintings and other curiosities. This church is dedicated to St Mary; is very advantageously situated in the middle of a large piazza, and built out of a great heap of wrought marble, such as pillars, pedestals, capitals, cornices, and architraves, part of the spoils which the Pisans took in their eastern expeditions, when the republic was in a flourishing condition. The roof is supported by 76 high marble pillars of different colours, and finely gilt. Both the church and the cupola are covered with lead. The choir is painted by good hands, and the floor is mosaic work. The brazen doors are curiously wrought with the history of the Old and New Testament, by Bonanno, an ancient statuary. The chapel of St Rainerius is richly adorned with gilt metals, columns of porphyry, and fine paintings. In the middle of the nave of the church you see two brazen tombs, raised upon pillars. The marble pulpit was carved by John Pisano, and the choir by Julian da Majana. Joining thereto is the altar, over which is preserved a hollow globe or vessel of marble, wherein they kept the sacrament for the new baptized, according to the opinion of Father Mabillon. In the square before the church, you see a pillar upon which is the measure of the ancient Roman talent. In the same square with the dome, stands the baptistery, a round fabric supported by stately pillars, and remarkable for a very extraordinary echo.

On the north side of the cathedral is the burying-place, called *Campo Santo*, being covered with earth brought from the Holy Land. This burying-place is inclosed with a broad portico, well painted, and paved with grave stones. Here are a great many ancient tombs, among the rest that of Beatrix, mother of the countess Mathilda, with marble basso relievos, which the Pisans brought from Greece, where you see the hunt of Meleager, which assisted Nicholas of Pisa in the restoration of sculpture. The walls of the Campo Santo are painted by the best masters of their times. Giotto has drawn six historical pieces of Job; and Andrea Orgagna has given a fine piece of the last judgment. Under the portico there is a decree of the city, ordering the inhabitants to wear mourning a year for the death of Cæsar.

Near the church you see a steeple in the form of a cylinder, to which you ascend by 153 steps; it inclines 15 feet on one side, which some ascribe to art, but others to the sinking of the foundation. Its inclination is so great that a plumb-line let fall from the top touches the ground at the distance of almost 15 feet from the bottom. It was built by John of Inspruck and Bonanno of Pisa, in 1174. Near this steeple is a fine hospital, dependent on that of St Maria Nuova in Florence.

The steeple of the church of the Augustinians is also very fine, being an octagon, adorned with pillars, and built by Nicholas of Pisa. In the great market-place there is a statue of Plenty, by Pierino da Vinci. In the church of St Matthew, the painting of the ceiling by the brothers Melani, natives of this city, is an admired performance. The church of the knights of St Stephen, decorated with the trophies taken from the Saracens, is all of marble, with marble steps, and a front adorned with marble statues. In the square there is a statue of Cosmo I. upon a very fine pedestal. Contiguous to the church is the convent or palace of the knights, which is worth seeing, as also the churches Della Madonna and Della Spina; the last of which was built by a beggar, whose figure you may see on the outside of the wall. It is pretended that one of the thorns of the crown which was placed on our Saviour's head is preserved here. Belonging to the university there is a great number of colleges, the chief of which is the Sapienza, where the professors read their public lectures; next to which are the colleges Puteano, Ferdinando, Ricci, and others. Besides the public palace, and that of the grand duke, there are several others with marble fronts, the finest of which is that of Lanfranchi, which, with the rest along the banks of the Arno, makes a very fine appearance. There is here a good dock, where they build the galleys, which are conveyed by the Arno to Leghorn. They have a famous aqueduct in this town, consisting of 5000 arches, which conveys the water from the hills at five miles distance. This water is esteemed the best in Italy, and is carried in flasks to Florence and Leghorn. The neighbouring country produces great store of corn and wine, but the latter is not much esteemed. They have very good butter in this neighbourhood, which is a scarce commodity in Italy. The city for its defence has a moat, walls, a castle, fort, and citadel; the last of which is a modern work. The Arno is of a considerable breadth here, and has three bridges over it, one of them of marble: two leagues below the town it falls into the sea. The physic-garden is very spacious, contains a great number of plants, and is decorated with waterworks: over the door leading into it are these words, *Hic Argus sed non Briareus esto:* i. e. "Employ the eyes of Argus, but not the hands of Briareus. The air is said to be unwholesome here in summer, on account of the neighbouring morasses. Many buffaloes are bred in the neighbouring country, and their flesh is commonly eaten. Between Pisa and Lucca are hot baths. E. Long. 10. 17. N. Lat. 43. 43.

PISCARY, in our ancient statutes, the liberty of fishing in another man's waters.

PISCES, in *Astronomy*, the 12th sign or constellation of the zodiac.

PISCIDIA, a genus of plants belonging to the diadelphia class. See BOTANY *Index*.

PISCIDIA Erythrina, or *Dogwood-tree*, is employed to intoxicate fish. For this purpose, the bark is pounded small, put into bags, and soaked in salt water. The juice, which is of a red colour, makes the fish stupid, so that they are easily taken.

PISCINA, in antiquity, a large bason in a public place or square, where the Roman youth learned to swim: and which was surrounded with a high wall, to prevent filth from being thrown into it.—This word is also used for a lavatory among the Turks, placed in the middle court of a mosque or temple, where the Mussulmans wash themselves before they offer their prayers.

Bibliotheca Classica, by Lempriere.

PISISTRATUS, an Athenian who early distinguished himself by his valour in the field, and by his address and eloquence at home. After he had rendered himself the favourite of the populace by his liberality and by the intrepidity with which he had fought their battles, particularly near Salamis, he resolved to make himself master of his country. Every thing seemed favourable to his ambitious views; but Solon alone, who was then at the head of affairs, and who had lately enforced his celebrated laws, opposed him, and discovered his duplicity and artful behaviour before the public assembly. Pisistratus was not disheartened by the measures of his relation Solon, but he had recourse to artifice. In returning from his country-house, he cut himself in various places; and after he had exposed his mangled body to the eyes of the populace, deplored his misfortunes, and accused his enemies of attempts upon his life, because he was the friend of the people, the guardian of the poor, and the reliever of the oppressed, he claimed a chosen body of 50 men from the populace to defend his person in future from the malevolence and the cruelty of his enemies. The unsuspecting people unanimously granted his request, though Solon opposed it with all his influence; and Pisistratus had no sooner received an armed band on whose fidelity and attachment he could rely, than he seized the citadel of Athens, and made himself absolute. The people too late perceived their credulity; yet, though the tyrant was popular, two of the citizens, Megacles and Lycurgus, conspired together against him, and by their means he was forcibly ejected from the city. His house and all his effects were exposed to sale; but there was found in Athens only one man who would buy them. The private dissensions of the friends of liberty proved favourable to the expelled tyrant; and Megacles, who was jealous of Lycurgus, secretly promised to restore Pisistratus to all his rights and privileges in Athens, if he would marry his daughter. Pisistratus consented; and by the assistance of his father-in-law, he was soon enabled to expel Lycurgus, and to re-establish himself. By means of a woman called *Phya*, whose shape was tall, whose features were noble and commanding, he imposed upon the people, and created himself adherents even among his enemies. Phya was conducted through the streets of the city, and showing herself subservient to the artifice of Pisistratus, she was announced as Minerva, the goddess of wisdom, and the patroness of Athens, who was come down from Heaven to re-establish her favourite Pisistratus in a power which was sanctioned by the will of Heaven, and favoured by the affection of the people. In the midst of his triumph, however, Pisistratus found himself unsupported; and some time after, when he repudiated the daughter of Megacles, he found that not only the citizens, but even his very troops, were alienated from him by the influence, the intrigues, and the bribery of his father-in-law. He fled from Athens where he no longer could maintain his power, and retired to Euboea. Eleven years after he was drawn from his obscure retreat, by means of his son Hippias, and he was a third time received by the people of Athens as their master and sovereign. Upon this he sacrificed to his resentment the friends of Megacles, but he did not lose sight of the public good, and while he sought the aggrandizment of his family, he did not neglect the dignity and the honour of the Athenian name. He died about 528 years before the Christian era, after he had enjoyed the sovereign power at Athens for 33 years, and he was succeeded by his son Hipparchus. Pisistratus claims our admiration for his justice, his liberality, and his moderation. If he was dreaded and detested as a tyrant, the Athenians loved and respected his private virtues and his patriotism as a fellow-citizen: and the opprobrium which generally falls on his head may be attributed not to the severity of his administration, but to the republican principles of the Athenians, who hated and exclaimed against the moderation and equity of the mildest sovereign, while they flattered the pride and gratified the guilty desires of the most tyrannical of their fellow subjects. Pisistratus often refused to punish the insolence of his enemies; and when he had one day been virulently accused of murder, rather than inflict immediate punishment upon the man who had criminated him, he went to the areopagus, and there convinced the Athenians that the accusations of his enemies were groundless, and that his life was irreproachable. It is to his labours that we are indebted for the preservation of the poems of Homer; and he was the first, according to Cicero, who introduced them at Athens in the order in which they now stand. He also established a public library at Athens; and the valuable books which he had diligently collected were carried into Persia when Xerxes made himself master of the capital of Attica. Hipparchus and Hippias the sons of Pisistratus, who had received the name of *Pisistratidæ*, rendered themselves as illustrious as their father; but the flames of liberty were too powerful to be extinguished. The Pisistratidæ governed with great moderation, but the name of tyrant or sovereign was insupportable to the Athenians. Two of the most respectable of the citizens, called *Harmodius* and *Aristogiton*, conspired against them, and Hipparchus was dispatched in a public assembly. This murder was not, however, attended with any advantages; and though the two leaders of the conspiracy, who have been celebrated through every age for their patriotism, were supported by the people, yet Hippias quelled the tumult by his uncommon firmness and prudence, and for a while preserved that peace in Athens which his father had often been unable to command. This was not long to continue. Hippias was at last expelled by the united efforts of the Athenians and of their allies, and he left Attica, when he found himself unable to maintain his power and independence. The rest of the family of Pisistratus followed him in his banishment; and after they had refused to accept the liberal offers of the princes of Thessaly, and the king of Macedonia, who wished them to settle in their respective territories, the Pisistratidæ retired to Sigæum, which their father had in the summit of his power conquered and bequeathed to his posterity. After the banishment of the Pisistratidæ, the Athenians became more than commonly jealous of their liberty, and often sacrificed the most powerful of their citizens, apprehensive of the influence which popularity and a well-directed liberality might gain among a fickle and unsettled populace. The Pisistratidæ were banished from Athens about 18 years after the death of Pisistratus.

PISMIRES, or **Ants**, are a kind of insects very common in Africa; of which there is so great a variety, and such innumerable swarms, that they destroy not only the fruits of the ground but sometimes even men and beasts in so little time as one single night; and would, without all doubt, prove more fatally destructive to the inhabitants, were they not so happily destroyed by a proportionable number of monkeys and other animals, who greedily devour them. The far greater part of the vast continent of Africa is afflicted with these and some other grievous plagues, and particularly with the horrid visitation of locusts, which seldom fail a year of laying waste some of the provinces.

PISO, Lucius Calpurnius, surnamed *Frugi* on account of his frugality, was descended of the illustrious family of the Pisos, which gave so many great men to the Roman republic. He was tribune of the people in the year 149 before Christ, and afterwards consul. During his tribuneship, he published a law against the crime of concussion or extortion, intitled *Lex Calpurnia de pecuniis repetundis*. He happily ended the war in Sicily. To reward the services of one of his sons, who had distinguished himself in that expedition, he left him by his will a golden crown, weighing 20 pounds. Piso joined to the qualties of a good citizen the talents of a lawyer, an orator, and historian.

Piso, *Caius Calpurnius*, a Roman consul in the year 67 before Christ, was author of the law which forbade canvassing for public offices, intitled *Lex Calpurnia de ambitu*. He displayed all the firmness worthy of a consul in one of the most stormy periods of the republic. The Roman people, deceived by the flattery of Marcus Palicanus, a turbulent and seditious fellow, were on the eve of loading themselves with the greatest disgrace, by putting the supreme authority into the hands of this man, who deserved punishment rather than honours. The tribunes of the people, by their harangues, inflamed the blind fury of the multitude, already sufficiently mutinous of themselves. In this situation, Piso mounted the rostrum, and being asked if he would declare Palicanus consul, in case the suffrages of the people should concur in the nomination, he instantly replied, that "he did not think the republic was yet involved in such darkness and despair as to be capable of committing so infamous an action." Being afterwards strongly and repeatedly called upon to say, "what he would do, if the thing should happen?" his answer was, "No, I would not name him." By this firm and laconic answer he deprived Palicanus of the dignity to which he aspired. Piso, according to Cicero, was not possessed of a quick conception, but he thought maturely, and with judgment, and, by a proper firmness, he appeared to be an abler man than he really was.

PISO, *Cneius Calpurnius*, was consul in the reign of Augustus, and governor of Syria under Tiberius, whose confidant he was. It is said, that by the order of this emperor he caused Germanicus to be poisoned. Being accused of that crime, and seeing himself abandoned by every body, he laid violent hands on himself in the 20th year of our Lord. He was a man of insupportable pride and excessive violence. Some instances of his wicked cruelty have been handed down to us. Having given orders in the heat of his passion to conduct to punishment a soldier, as guilty of the death of one of his companions, because he had gone out of the camp with him and returned without him, no prayers or intreaty could prevail with Piso to suspend the execution of this sentence until the affair should be properly investigated. The soldier was led without the entrenchments, and had already presented his head to receive the fatal stroke, when his companion whom he was accused of having killed made his appearance again. Whereupon the centurion, whose office it was to see the sentence executed, ordered the executioner to put up his sword into the scabbard. Those two companions, after embracing each other, are conducted to Piso, amidst the acclamations of the whole army, and a prodigious crowd of people. Piso, foaming with rage, ascends his tribune, and pronounces the same sentence of death against the whole three, without excepting the centurion who had brought back the condemned soldier, in these terms: "You I order to be put to death because you have been already condemned: you, because you have been the cause of the condemnation of your comrade; and you, because having got orders to put that soldier to death, you have not obeyed your prince."

PISSASPHALTUM, or ASPHALTUM, EARTH-PITCH; a fluid, opaque, mineral body, of a thick consistence, strong smell, readily inflammable, but leaving a residuum of grayish ashes after burning. It arises out of the cracks of the rocks, in several places in the island of Sumatra, and some other places in the East Indies, where it is much esteemed in paralytic disorders. There is a remarkable mine of it in the island of Bua, (see BUA), of which the following curious description is given by the abbé Fortis. "The island is divided into two promontories between the north and west. Crossing over the top of the latter, which is not half a mile broad, and descending in a right line towards the sea, one is conducted to a hole well known to the inhabitants. This hole extends not much above 12 feet, and from its bottom above 25 feet perpendicular, arise the marble strata which sustain the irregular masses that surround the top of the mountain.

This pissasphaltum is of the most perfect quality, black and shining, very pure, odorous, and cohesive; and it comes out almost liquid, but hardens in large drops when the sun sets. On breaking many of these drops on the spot, I found that almost every one of them had an inner cavity full of very clear water.

"The greatest breadth of the tears that I saw was two inches, and the common breadth is half an inch. The chinks and fissures of the marble, from whence this bituminous pitch transudes, are not more than the thickness of a thread; and for the most part are so imperceptible, that were it not for the pitch itself, whereby they are blackened, they could not by any means be distinguished by the naked eye. To the narrowness of these passages is, no doubt, in part owing the small quantity of pissasphaltum that transpires."

After some conjectures about the origin of this mine, our author proceeds to inform us that the pissasphaltum of Bua is correspondent to that fossil production which by Hasselquist, in his Travels, is called *mumia minerale*, and *mumia nativa Persiana* by Kempfer, which the Egyptians made use of to embalm their kings (A). It is found in a cave of Mount Caucasus, which is kept shut, and carefully guarded by order of the king of Persia. One of the qualities assigned by Linnæus to the finest bitumen is to smoke when laid on the fire, as ours does, emitting a smell of pitch not disagreeable. He believes it would be very good for wounds, as the oriental mumia is, and like the pitch of Castro, which is frequently used by the Roman chirurgeons for fractures, contusions, and in many external applications. See ASPHALTUM, MINERALOGY *Index*.

PISSELÆUM INDICUM, *Barbadoes Tar*; a mineral fluid of the nature of the thicker bitumens, and of all others the most approaching, in appearance, colour, and consistence, to the true pissasphaltum, but differing from it in other respects. It is very frequent in many parts of America, where it is found trickling down the sides of mountains in large quantities, and sometimes floating on the surface of the waters. It has been greatly recommended internally in coughs and other disorders of the breast and lungs.

PISTACIA, TURPENTINE-TREE, *Pistachia nut* and *Mastich-tree*; a genus of plants belonging to the diœcia class. The most remarkable species are, 1. The terebinthus, or pistachia-tree, which grows naturally in Arabia, Persia, and Syria, whence the nuts are annually brought to Europe. In those countries it grows to the height

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(A) "Mumiahi, or native Persian mummy. It proceeds from a hard rock in very small quantity. It is a bituminous juice, that transudes from the stony superficies of the hill, resembling in appearance coarse shoemakers wax, as well in its colour as in its density and ductility. While adherent to the rock it is less solid, but is formed by the warmth of the hands. It is easily united with oil, but repels water; it is quite void of smell, and very like in substance to the Egyptian mummy. When laid on burning coals, it has the smell of sulphur tempered a little with that of naphtha, not disagreeable. There are two kinds of this mummy; the one is valuable for its scarcity and great activity. The native place of the best mummy is far from the access of men, from habitations, and from springs of water, in the province of Daraab. It is found in a narrow cave, not above two fathoms deep, cut like a well out of the mass, at the foot of the rugged mountain Caucasus."—*Kempfer. Amœn. Pers.*

This description agrees perfectly with the pissasphaltum or fossil mummy of Bua, differing only in the privation of smell, which it is difficult to imagine is totally wanting in the Persian mummy.

height of 25 or 30 feet: the bark of the stem and old branches is of a dark russet colour, but that of the young branches is of a light brown. These are garnished with winged leaves, composed sometimes of two, at other times of three, pair of lobes, terminated by an odd one; these lobes approach towards an oval shape, and their edges are turned backward; and these, when bruised, emit a smell similar to that of the shell of the nut. Some of these trees produce male and others female flowers, and some have both male and female on the same tree. The male flowers come out from the sides of the branches in loose bunches or catkins. They have no petals, but five small stamina crowned by large four-cornered summits filled with farina; and when this is discharged, the flowers fall off. The female flowers come out in clusters from the sides of the branches: they have no petals, but a large oval germen supporting three reflexed styles, and are succeeded by oval nuts. 2. The lentiscus, or common mastich tree, grows naturally in Portugal, Spain, and Italy. Being an evergreen, it has been preserved in this country in order to adorn the green-houses. In the countries where it is a native, it rises to the height of 18 or 20 feet, covered with a gray bark on the stem; but the branches, which are very numerous, are covered with a reddish brown bark, and are garnished with winged leaves, composed of three or four pair of small spear-shaped lobes, without an odd one at the end. 3. The orientalis, or true mastich tree of the Levant, from which the mastich is gathered, has been confounded by most botanical writers with the lentiscus, or common mastich tree, above described, though there are considerable differences between them. The bark of the tree is brown; the leaves are composed of two or three pair of spear-shaped lobes, terminated by an odd one: the outer lobes are the largest; the others gradually diminish, the innermost being the least. These turn of a brownish colour towards the autumn, when the plants are exposed to the open air; but if they are under glasses, they keep green. The leaves continue all the year, but are not so thick as those of the common sort, nor are the plants so hardy.

Culture. The first species is propagated by its nuts, which should be planted in pots filled with light kitchen-garden earth, and plunged into a moderate hot-bed to bring up the plants; when these appear, they should have a large share of air admitted to them, and by degrees they should be exposed to the open air, which at last they will bear in all seasons, though not without great danger of being destroyed in severe winters. The second sort is commonly propagated by laying down the branches, though it may also be raised from the seed in the manner already directed for the pistachia-nut tree: and in this manner also may the true mastich-tree be raised. But this being more tender than any of the other sorts, requires to be constantly sheltered in winter, and to have a warm situation in summer.

Pistachia nuts are moderately large, containing a kernel of a pale greenish colour, covered with a reddish skin. They have a pleasant, sweet, unctuous taste, resembling that of almonds; and they abound with a sweet and well-tasted oil, which they yield in great abundance on being pressed after bruising them: they are reckoned among the analeptics, and are wholesome and nutritive, and are by some esteemed very proper to be prescribed by way of restoratives, eaten in small quantity, to people emaciated by long illness.

PISTIL, among botanists, the little upright column which is generally found in the centre of every flower. According to the Linnæan system, it is the female part of generation, whose office is to receive and secrete the pollen, and produce the fruit. It consists of three parts, viz. germen, stylus, and stigma. See BOTANY *Index*.

PISTOIA is a city of Italy, in the duchy of Tuscany, situated on the river Stella, in a beautiful plain near the foot of the Apennine mountains. By Pliny it is called *Pistorium*, and is said to have been once a Roman colony. At present it is a bishop's see, suffragan of Florence. The streets are broad and regular, the houses tolerably well built, but poorly inhabited for want of trade. Formerly it was an independent republic, but since it was subdued by the Florentines in 1200, it has been in a declining condition. The cathedral has a very handsome cupola, and a magnificent staircase to ascend to it. In the chapel dedicated to St James, where his relics are preserved, the walls are almost covered with plates of silver. Here are four marble statues of very good workmanship. The marble pulpit, the basso-relievos, the vessel that holds the holy water, and the square-steeple, are the work of John Pisano. The Jesuits have a very fine college, and the Franciscans, Dominicans, and Augustinians, good churches. In the church of Madonna dell' Umilta there are two statues, one of Leo X. and the other of Clement VII. The public palace, situated in a large square, is a handsome building; several of the nobility have also very good houses. In the neighbouring mountains, called by the name of Pistoia, there are many large villages, the chief of which is that of S. Marcello, belonging to the family of Cartoli. These mountains are a part of the Apennines, and border on the territory of Bologna and the county of Vernio; higher up is the source of the river Reno. The country about Pistoia, especially towards Florence, is exceeding fertile and delightful, covered with all sorts of fruits, corn, wine, &c. and containing a vast number of little towns, wealthy villages, and country seats, so as to be reckoned the richest and most beautiful in all Tuscany. It is about 20 miles N. W. of Florence, and 30 N. E. of Pisa. E. Long. 11. 29. N. Lat. 43. 55.

PISTOL, the smallest piece of fire-arms, borne at the saddle-bow, in the girdle, and in the pocket.

PISTOLE, a gold coin, struck in Spain and in several parts of Italy, Switzerland, &c.—The pistole has its augmentations and diminutions, which are quadruple pistoles, double pistoles, and half pistoles. See MONEY-*Table*.

PISTON, in pump-work, is a short cylinder of metal or other solid substance, fitted exactly to the cavity of the barrel or body of the pump. See HYDRODYNAMICS.

PISUM, PEASE; a genus of plants belonging to the diadelphia class. See BOTANY *Index*. The species are, 1. The sativum, or greater garden-pea, whose lower stipulæ are roundish, indented, with taper foot-stalks, and many flowers on a foot-stalk. 2. The humile, or dwarf pea, with an erect branching stalk, and leaves having two pair of round lobes. 3. The umbellatum, rose or crown-pea, with four pointed acute stipuli, and foot-stalks bearing many flowers, which terminate the stalks. 4. The maritimum, or sea-pea, with foot-stalks which are plain on their upper side, an angular stalk, arrow-pointed stipulæ, and foot-stalks bearing many flowers. 5. The Americanum, commonly called *Cape-Horn pea*, with an angular trailing stalk, whose lower leaves are spear-shaped, sharply indented, and those at the top arrow-pointed. 6. The ochrus, with membranaceous running foot-stalks, having two leaves and one flower upon a foot-stalk.

There is a great variety of garden-pease now cultivated in Britain, which are distinguished by gardeners and seedsmen, and have their different titles; but as great part of these have been seminal variations, so if they are not very carefully managed, by taking away all those plants which have a tendency to alter before the seeds are formed, they will degenerate into their original state: therefore all those persons who are curious in the choice of their seeds, look carefully over those which they design for seeds at the time when they begin to flower, and draw out all the plants which they dislike from the other. This is what they call *roguing their pease;* meaning hereby the taking out all the bad plants from the good, that the farina of the former may not impregnate the latter; to prevent which, they always do it before the flowers open. By thus diligently drawing out the bad, reserving those which come earliest to flower, they have greatly improved their pease of late years, and are constantly endeavouring to get forwarder varieties; so that it would be to little purpose in this place to attempt giving a particular account of all the varieties now cultivated: we shall therefore only mention the names by which they are commonly known, placing them according to their time of coming to the table, or gathering for use.

The golden hotspur.
The Charlton.
The Reading hotspur.
Master's hotspur.
Essex hotspur.
The dwarf pea.
The sugar pea.
Spanish Morotto.
Nonpareil.
Sugar dwarf.
Sickle pea.
Marrowfat.
Rose or crown pea.
Rouncival pea.
Gray pea.
Pig pea; with some others.

The English sea-pea is found wild upon the shore in Sussex and several other counties in England, and is undoubtedly a different species from the common pea.

The fifth species hath a biennial root, which continues two years. This was brought from Cape Horn by Lord Anson's cook, when he passed that cape, where these pease were a great relief to the sailors. It is kept here as a curiosity, but the pease are not so good for eating as the worst sort now cultivated in Britain. It is a low trailing plant; the leaves have two lobes on each foot-stalk: those below are spear-shaped, and sharply indented on their edges; but the upper leaves are small, and arrow-pointed. The flowers are blue, each foot-stalk sustaining four or five flowers; the pods are taper, near three inches long; and the seeds are round, about the size of tares.

The sixth sort is annual. This grows naturally among the corn in Sicily and some parts of Italy, but is here preserved in botanic gardens for the sake of variety. It hath an angular stalk, rising near three feet high; the leaves stand upon winged foot-stalks, each sustaining two oblong lobes. The flowers are of a pale yellow colour, shaped like those of the other sort of pea, but are small, each foot-stalk sustaining one flower; these are succeeded by pods about two inches long, containing five or six roundish seeds, which are a little compressed on their sides. These are by some persons eaten green; but unless they are gathered very young, they are coarse, and at best not so good as the common pea. It may be sown and managed in the same way as the garden pea.

For an account of the method of cultivating the several sorts of garden pease, so as to continue them throughout the season, see GARDENING.

The gray and other large winter pease are seldom cultivated in gardens, because they require a great deal of room; they are therefore usually sown in fields. For the proper method of managing them, see AGRICULTURE.

In the *Museum Rusticum*, vol. i. p. 109. we find the following method of preparing pease for hog-meat, which we shall give in the words of the ingenious farmer who communicated it.

"A few years ago (says he), I had a plentiful crop of pease on a ten acre piece, which lies near my house: when they were full poded and nearly ripe, I had them hooked in the usual manner; but before I could get them in, there came a heavy shower of rain which wetted them through and through; and the dull heavy weather, with frequent showers which followed, prevented their drying for a considerable time.

"I caused the wads to be from time to time turned, to prevent the haulm from rotting; and at length a few days sunshine dried them enough to be inned; for as they lay hollow, the wind was greatly assistant to the operation.

"Before I got them in, on examining some of the pods, I found that the pease were all sprouted to a considerable length: this was what I had expected, as I gave my crop over for lost, till after a little recollection, as the weather still continued fine, I determined to thresh them in the field.

"This was accordingly done; and the corn, after it was cast and riddled to separate it from the rubbish, was dried on my malt kiln.

"When this operation was over, I began to reflect in what manner I should dispose of my pease, being sensible that they could not be proper for seed, and standing no chance of disposing of them to any advantage in the market.

"At length, as it was then a time of war, and of course there was a great demand for pork for the use of the navy, I determined to buy a considerable number of lean hogs, that I might by their means consume this crop on my own premises, and in that manner make the most of it.

"My expectations were more than answered; for I found, by repeated experience, that three bushels of the pease I have mentioned went nearly as far in fattening the hogs I bought as four bushels got in dry and hard in the manner usually practised.

"This discovery I made several years ago, and it has turned out to my advantage; for since that time I have been quite indifferent as to the weather in which my pease are hooked, being rather better pleased, as far as relates to them, with wet than dry weather;

ther; but if the weather happens to be dry at the time they are ripe, I always cause as many as I want for feeding my hogs, which are not a few in a year, to be regularly malted in the same manner nearly as my barley: this management has of late succeeded very well with me, and I therefore intend to continue it.

" Besides feeding my hogs with these malted pease, I have often given them to my horses, with which they agree very well, and are heartening food.

" Turkeys will fatten apace on them also, and be fine meat.

" I have applied my malted pease to many other uses, which I have not at present time to enumerate: but were they only used for feeding hogs and horses, it is still worth while to prepare some in this manner every year."

PIT-COAL, or **STONE-COAL**. See COAL, MINERALOGY *Index* and COALERY.

The coal-trade is of infinite importance to Great Britain, which never could have arrived at its present commercial eminence without it; and this eminence it will be impossible to retain if coal should ever become scarce. This we trust is not likely to be the case, though Mr Williams expresses great fears for it, and informs us that at Newcastle and in many parts of Scotland, the mines near the sea are already wasted, the first consequence of which must be an enormous rise in the price. See his observations on this subject in his *Natural History of the Mineral Kingdom*. This author says, that coal was not discovered till between the middle of the 12th and beginning of the 13th centuries: it is, therefore, according to him, 400 years since it was first discovered in Britain, but they have not been in common use for more than 200 years. The same author makes many excellent observations on the appearances and indications of coal, instructions about searching for it, remarks on false and doubtful symptoms of coal; for all which, together with his observations on the different kinds of Scots coal, we shall refer our readers to the work itself; the first part of which, occupying a large proportion of it, is upon the *strata of coal*, and on the *concomitant strata*. See GEOLOGY and STRATA *of the earth*.

PITAHAYA (*Cactus Pitajaya*. Lin. *Syst. Vegetabilium*. *Jacquin*. *Amer*. 151. ed. 2d. p. 75. M. *E. Carthagena*), a shrub peculiar to California, the fruit of which forms the greatest part of the harvest of the natives. Its branches are finely fluted, and rise vertically from the stem, so as to form a very beautiful top. The fruit is like a horse-chesnut; in some white, in others yellow, and in others red, but always exquisitely delicious, being a rich sweet, tempered with a grateful acid. See CACTUS, BOTANY *Index*.

PITCAIRNE, DR ARCHIBALD, an eminent physician and ingenious poet, was descended from the ancient family of the Pitcairnes of Pitcairne in Fifeshire, and was born at Edinburgh on the 25th of December 1652. He commenced his studies at the school of Dalkeith; and from thence he was removed to the university of Edinburgh, where he improved himself in classical learning, and completed a regular course of philosophy. His friends, according to the authors of the *Biographia Britannica*, were desirous that he should follow the profession of theology. The unpleasant gloom, however, which at that time hung over religion and its professors in Scotland, could not but very ill suit with that native cheerfulness of temper and liberality of mind which made him, long after, a mark for the arrows of preciseness and grimace. The law seems to have been his own choice, and to this science he turned his attention. With an ardour peculiar to himself, and an ambition to excel in whatever he undertook, he pursued it with so much intenseness, that his health began to be impaired. On this account, his physicians advised him to set out for the south of France. By the time he reached Paris, he was happily so far recovered, that he determined to renew his studies; but being informed that there was no able professor of law in that city, and finding several gentlemen of his acquaintance engaged in the study of physic, he went with them to the lectures and hospitals, and employed himself in this manner for several months till his affairs called him home.

On his return, he applied himself chiefly to the mathematics. It is not usual to see the briars of this science and the flowers of poetry growing in the same soil. Here, however, they were happily united; and to this union perhaps was owing that singular command of judgment, over one of the liveliest of fancies, which appears in every part of his works. His intimacy with Dr David Gregory, the celebrated mathematical professor, began about the same time; and probably conduced to cherish his natural aptitude for this study. It was then in a great measure, new to him; it soon became his principal delight; his progress in it was rapid, and correspondent to his progress in other pursuits. His improvements on the method of infinite series then adopted, which Dr Wallis of Oxford afterwards published, were a conspicuous and early proof of his abilities in this science.

Had Dr Pitcairne continued to prosecute the study of the law, and could he have moulded his principles to the times, the first offices and honours of the state might have been looked for without presumption as the probable reward of such talents as he possessed. Struck, however, with the charms of mathematical truth which had been lately introduced into the philosophy of medicine, and hoping to reduce the healing art to geometrical method, he unalterably determined on this less aspiring profession. At the period when he formed this resolution, the ideas of the medical world, already sufficiently confused, were still farther jumbled by the discovery of the circulation of the blood, which had as yet produced nothing but doubt, uncertainty, and astonishment. In Edinburgh at that time there was no school, no hospital, no opportunity of improvement but the chamber and the shop. He therefore soon after returned to Paris. Genius and industry are unhappily not often united in the same character: of such an union, however, Dr Pitcairne is a celebrated instance. During his residence in France, he cultivated the object of his pursuit with his natural enthusiasm, and with a steadiness from which he could not be diverted by the allurements of that joy which, in his hours of social and festive intercourse, he always felt and always gave. Among his various occupations, the study of the ancient physicians seems to have had a principal share. This appears from a treatise which he published some time after his return; and it shows, that he wisely determined to know the progress of medicine from its earliest periods, before he attempted to reform and improve that science.

On the 13th of August 1680, he received, from the faculty of Rheims, the degree of Doctor; which, on the 7th of August 1699, was likewise conferred on him by the university of Aberdeen; both being attended with marks of peculiar distinction. Other medical honours are said to have been conferred on him in France and elsewhere; but nothing affords a more unequivocal testimony to his abilities than that which the surgeons of Edinburgh gave, in admitting him, freely and unsolicited, a member of their college. None had such opportunities of judging of his merit as a practitioner, and on no physician did they ever bestow the same public mark of respect. Soon after his graduation at Rheims, he returned to Edinburgh; where, on the 29th of November 1681, the Royal College of Physicians was instituted; and his name, among others, graced the original patent from the crown.

In his *Solutio Problematis de Inventoribus*, the treatise above alluded to, he discovers a wonderful degree of medical literature, and makes use of it in a manner that does great honour both to his head and his heart. His object is to vindicate Dr Harvey's claim to the discovery of the circulation of the blood. The discovery was, at first, controverted by envy, and reprobated by ignorance. When at length its truth was fully established, many invidiously attempted to tear the laurels from the illustrious Englishman, and to plant them on the brows of Hippocrates and others. Had the attempt been directed against himself, the generous soul of Pitcairne could not have exerted more zeal in a defence; and his arguments remain unanswered.

During his residence in Scotland, his reputation became so considerable, that, in the year 1691, the university of Leyden solicited him to fill the medical chair, at that time vacant. Such an honourable testimony of respect, from a foreign nation, and from such an university, cannot perhaps be produced in the medical biography of Great Britain. The lustre of such characters reflects honour on their profession, and on the country which has the good fortune of giving them birth; and serves to give the individuals of that country not only a useful estimation in their own eyes, but in those also of the rest of the world. Dr Pitcairne's well-known political principles excluded him from public honours and promotion at home: he therefore accepted the invitation from abroad; and, on the 26th of April 1692, delivered, at Leyden, his elegant and masterly inaugural oration: *Oratio qua ostenditur medicinam ab omni philosophorum secta esse liberam*. In this he clears medicine from the rubbish of the old philosophy; separates it from the influence of the different sects; places it on the broad and only sure foundation of experience; shows how little good inquiries into the manner how medicines operate have done to the art; and demonstrates the necessity of a sedulous attention to their effects, and to the various appearances of disease.

Nothing (says an elegant panegyrist * of our author) marks a superiority of intellect so much as the courage requisite to stem a torrent of obstinately prevailing and groundless opinions. For this the genius and talents of Pitcairne were admirably adapted; and, in his oration, he displays them to the utmost. It was received with the highest commendations; and the administrators, to testify their sense of such an acquisition to their university, greatly augmented the ordinary appointment of his chair.

He discharged the duties of his office at Leyden so as to answer the most sanguine expectations. He taught with a perspicuity and eloquence which met with universal applause. Independently of the encomiums of Boerhaave and Mead, who were his pupils, the numerous manuscript copies of his lectures, and the mutilated specimen of them † which found its way into the world without his knowledge, show how justly it was bestowed. At the same time, he was not more celebrated as a professor than as a practical physician; and notwithstanding the multiplicity of his business in both these characters, he found leisure to publish several treatises on the circulation, and some other of the most important parts of the animal economy (A).

At the close of the session he set out for Scotland, with an intention of returning in time for the succeeding one. On his marrying (B) the daughter of Sir Archibald Stevenson, the object of his journey, her relations would on no account consent to part with him again. He was therefore reluctantly obliged to remain; and he wrote the university a polite apology, which was received with the utmost regret. He even declined the most flattering solicitations and tempting offers to settle in London. Indeed he soon came into that extensive practice to which his abilities entitled him, and was also appointed titular professor of medicine in the university of Edinburgh.

The uniformity of a professional life is seldom interrupted by incidents worthy of record. Specimens, however, of that brilliant wit with which he delighted his friends in the hours of his leisure, continue to entertain us (C): and the effects of that eminent skill which he exerted

* Dr Chas Webster, in the *Harveian Oration at Edinburgh* for the year 1781; from which performance the present article is chiefly extracted.

† *Elementa Medicinæ.*

(A) Dr Boerhaave gives the following character of these and some other of Dr Pitcairne's dissertations, which were collected and published at Rotterdam, anno 1701: "Hæc scripta optima sunt et perfecta, sive legas Dissertationem de Motu Sanguinis per Pulmones, sive alia opuscula, sive ultimum tractatum de Opio." *Methodus studii, ab Hallero edita*, p. 569.

(B) He had been married before to a daughter of Colonel James Hay of Pitfour, by whom he had a son and daughter, who both died young.

(C) Vide *Pitcarnii Poemata*.—Several of his poems, however, are obscure, and some of them totally unintelligible without a key. In those of them which are of a political kind, he wished not to express himself too clearly; and in others, he alludes to private occurrences which were not known beyond the circle of his companions. His poem *(Ad Lindesium)*, addressed to his friend Lindsey, is commented on by the authors of the *Biographia Britannica;* and it is to be regretted that it is the only one on which they have been solicitous to throw light, exerted in the cure of disease, still operate to the good of posterity.

The discovery of the circulation, while in some measure it exploded the chemical and Galenical doctrines, tended to introduce mathematical and mechanical reasoning in their stead. Of this theory (D) Dr Pitcairne was the principal support, and the first who introduced it into Britain. A mathematical turn of mind, and a wish for mathematical certainty in medicine, biassed him in its favour, and he pushed it to its utmost extent. One is at a loss whether most to admire or regret such a waste of talents in propping a theory which, though subversive of former ones, was to fall before others but a little more satisfactory than itself. Mechanical physicians expected more from geometry than that science could grant. They made it the foundation instead of an auxiliary to their inquiries, and applied it to parts of nature not admitting mathematical calculations. By paying more attention afterwards to the supreme influence of the living principle, the source of all the motions and functions of the body, it was found that these could not be explained by any laws of chemistry or mechanism. They are still, however, involved in obscurity; and notwithstanding the numberless improvements which have taken place in the sciences connected with medicine, will perhaps remain inscrutable while man continues in his present stage of existence.

In a science so slowly progressive as that of medicine, Dr Pitcairne did a great deal. By labouring in vain for truth in one road, he saved many the same drudgery, and thereby showed the necessity of another. He not only exploded many false notions of the chemists and Galenists which prevailed in his time, but many of those too of his own sect. In particular, he showed the absurdity of referring all diseases and their cures to an alkali or an acid (E). He refuted the idea of secretion being performed by pores differently shaped (F), Bellini's opinion of effervescences in the animal spirits with the blood, and Borelli's of air entering the blood by respiration (G). He proved the continuity of the arteries and veins (H); and seems to have been the first who showed that the blood flows from a smaller capacity into a larger; that the aorta, with respect to the arterial system, is the apex of a cone (I). In this therefore he may be considered as the latent spring of the discoveries respecting the powers moving the blood. He introduced a simplicity of prescription unknown in pharmacy before his time (K); and such was the state of medicine in this country, that scarcely have the works of any cotemporary or preceding author been thought worthy even of preservation (L). As to the errors of his philosophy, let it be remembered, that no theory has as yet stood the test of many years in an enlightened period. His own hung very loosely

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light. "Some parts (say they) of this poem, are hardly intelligible, without knowing a circumstance in the doctor's life, which he often told, and never without some emotion. It is a well known story of the two Platonic philosophers, who promised one another, that whichever died first should make a visit to his surviving companion. This story being read by Mr Lindsey and our author together, they being both then very young, entered into the same engagement. Soon after, Pitcairne, at his father's house in Fife, dreamed one morning that Lindsey, who was then at Paris, came to him, and told him he was not dead, as was commonly reported, but still alive, and lived in a very agreeable place, to which he could not yet carry him. By the course of the post news came of Lindsey's death, which happened very suddenly the morning of the dream. When this is known, the poem is easily understood, and shines with no common degree of beauty.

"Lyndesi! Stygias jamdudum vecte per undas,
"Stagnaque Cocyti non adeunda mihi;
"Excute paulisper Lethæi vincula somni,
"Ut feriant animum carmina nostra tuum.
"Te nobis, te redde tuis, promissa daturus
"Gaudia; sed proavo sis comitante redux:
"Namque novos viros mutataque regna videbis,
"Passaque Teutonicas sceptra Britanna manus *.

* Written in 1689.

"He then proceeds to exclaim against the principles and practices which produced this Teutonic violence upon the British sceptre; and concludes with a wish, that Lindsey might bring Rhadamanthus with him to punish them.

"Unus abest scelerum vindex Rhadamanthus; amice,
"Dii faciant reditus sit comes ille tui.

"Every one sees how much keener an edge is given to the satire upon the Revolution, by making it an additional reason for his friend's keeping his promise to return him a visit after his death."

(D) See the article PHYSIOLOGY.

(E) *Pitcarnii Dissertationes*, Edin. edit. 1713. De opera quam præstant corpora acida vel alkalica in curatione morborum.

(F) De circulatione sanguinis per vasa minima.

(G) De diversa mole qua sanguis fluit per pulmones.

(H) De circulatione sanguinis per vasa minima.

(I) De circulatione sanguinis in animalibus genitis et non genitis.

(K) *Elementa Medicinæ*, lib. i. cap. 21. et passim.

(L) The first medical publication which distinguished this country, after Dr Pitcairne's, was that of the Edinburgh Mecical Essays, in the year 1732. Vide the article MONRO.

loosely about him (M); and the present generally received practice differs from his very little in reality. He treated inflammatory and hemorrhagic diseases by bleeding, purging, and blistering, as has been done uniformly and solely on the different theories since. His method of administering mercury and the bark is observed at this day; and with respect to febrile, nervous, glandular and dropsical affections, they seem to be as often the opprobriums of the art now as they were then.

Dr Pitcairne was universally considered as the first physician of his time. No one appears ever to have had so much practice in this country, or so many consultations from abroad; and no one, from all accounts, ever practised with greater sagacity and success. The highest thought themselves honoured by his acquaintance, and the lowest were never denied his assistance and advice. The emoluments of his profession must have been great; but his charities are known to have been correspondent. The possession of money he postponed to more liberal objects; he collected one of the finest private libraries in the world; which was purchased, after his death, by the Czar of Muscovy. Notwithstanding the fatigues he underwent in the exercise of his profession, his constitution was naturally delicate. About the beginning of October 1713, he became affected with his last illness; and on the 23d he died, regretted by science as its ornament, by his country as its boast, and by humanity as its friend. He left a son and four daughters: of whom only one of the latter now survives. The present noble family of Kelly are his grandchildren.

Some anonymous publications are attributed to Dr Pitcairne, particularly a treatise *De Legibus Historiæ Naturalis*, &c.; but the only ones he thought proper to legitimate are his *Dissertationes Medicæ*, and a short essay *De Salute*.

PITCAITHLY. See PITKEATHLY.

PITCH, a tenacious oily substance, drawn chiefly from pines and firs, and used in shipping, medicine, and various arts: or it is more properly tar inspissated by boiling it over a slow fire. See TAR.

Fossil PITCH. See PETROLEUM, MINERALOGY *Index*.

PITCHING, in sea-affairs, may be defined the vertical vibration which the length of a ship makes about her centre of gravity; or the movement by which she plunges her head and after-part alternately into the hollow of the sea. This motion may proceed from two causes: the waves which agitate the vessel; and the wind upon the sails, which makes her stoop to every blast thereof. The first absolutely depends upon the agitation of the sea, and is not susceptible of inquiry; and the second is occasioned by the inclination of the masts, and may be submitted to certain established maxims.

When the wind acts upon the sails, the mast yields to its effort, with an inclination which increases in proportion to the length of the mast, to the augmentation of the wind, and to the comparative weight and distribution of the ship's lading.

The repulsion of the water, to the effort of gravity, opposes itself to this inclination, or at least sustains it, by as much as the repulsion exceeds the momentum, or absolute effort of the mast, upon which the wind operates. At the end of each blast, when the wind suspends its action, this repulsion lifts the vessel; and these successive inclinations and repulsions produce the movement of pitching, which is very inconvenient; and, when it is considerable, will greatly retard the course, as well as endanger the mast, and strain the vessel.

PITH, in vegetation, the soft spongy substance contained in the central parts of plants and trees *.

PITHO, in fabulous history, the goddess of persuasion among the Romans. She was supposed to be the daughter of Mercury and Venus, and was represented with a diadem on her head, to intimate her influence over the hearts of man. One of her arms appeared raised as in the attitude of an orator haranguing in a public assembly; and with the other she holds a thunderbolt and fetters, made with flowers, to signify the powers of reasoning and the attractions of eloquence. A caduceus, as a symbol of persuasion, appears at her feet, with the writings of Demosthenes and Cicero, the two most celebrated among the ancients, who understood how to command the attention of their audience, and to rouse and animate their various passions.—A Roman courtezan. She received this name on account of the allurements which her charms possessed, and of her winning expressions.

PITHOM, one of the cities that the children of Israel built for Pharaoh in Egypt (Exod. i. 11.) during the time of their servitude. This is probably the same city with Pathumos mentioned by Herodotus, which he places upon the canal made by the kings Necho and Darius to join the Red sea with the Nile, and by that means with the Mediterranean. We find also in the ancient geographers, that there was an arm of the Nile called *Pathmeticus*, *Phatmicus*, *Phatnicus*, or *Phatniticus*. Bochart says, that Pithom and Raamses are about five leagues above the division of the Nile, and beyond this river; but this assertion has no proof from antiquity. This author contents himself with relating what was said of Egypt in his own time. Marsham will have Pithom to be the same as Pelusium or Damietta.

PITHOU, or PITHOEUS, *Peter*, a Frenchman of great literary eminence, was descended from an ancient and noble family in Normandy, and born at Troyes in 1539. His taste for literature appeared very early, and his father cultivated it to the utmost. He first studied at Troyes, and was afterwards sent to Paris, where he became first the scholar, and then the friend, of Turnebus. Having finished his pursuits in languages and the belles lettres, he was removed to Bourges, and placed under Cujacius in order to study civil law. His father was well skilled in his profession, and has left no inconsiderable specimen of his judgment in the advice he gave his son with regard to acquiring a knowledge of it; which was, not to spend his time and pains upon voluminous and barren commentators, but to confine his reading chiefly to original writers. He made so rapid a progress, that at seventeen he was able to speak extempore upon the most difficult questions; and his master was not ashamed to own, that even himself had learned some things of him. Cujacius afterwards removed to Valence; and Pithœus followed him, and continued to profit by his lectures till the year 1560. He then returned to Paris, and frequented the bar of the parliament there, in order to join practical forms and usages to his theoretic knowledge.

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* See Plant.

(M) Patet (*says he*) medicinam esse memoriam eorum quæ cuilibet morbo usus ostendit fuisse utilia. Nam notas non esse corporum intra venas fluentium aut consistentium naturas, adeoque sola observatione innotescere quid cuique morbo conveniat postquam sæpius eadem eidem morbo profuisse comperimus. *De Div. Morb.*

In 1563, being then 24, he published *Adversaria Subcesiva*, a work highly applauded by Turnebus, Lipsius, and other learned men; and which laid the foundation of that great and extensive fame he afterwards acquired. Soon after this, Henry III. advanced him to some considerable posts; in which, as well as at the bar, he acquitted himself most honourably. Pithœus being a Protestant, it was next to a miracle that he was not involved in the terrible massacre of St Bartholomew in 1572; for he was at Paris when it was committed, and in the same lodgings with several Huguenots, who were all killed. It seems indeed to have frightened him out of his religion; which having, according to the custom of converts, examined and found to be erroneous, he soon abjured, and openly embraced the Catholic faith. He afterwards attended the duke of Montmorency into England; and on his return, from his great wisdom, good nature, and amiable manners, he became a kind of oracle to his countrymen, and even to foreigners, who consulted him on all important occasions; an instance of which we have in Ferdinand the grand duke of Tuscany, who not only consulted him, but even submitted to his determination in a point contrary to his interests. Henry III. and IV. were greatly obliged to him for combating the League in the most intrepid manner, and for many other services, in which he had recourse to his pen as well as to other means.

Pithœus died upon his birth-day in 1596, leaving behind him a wife whom he had married in 1579, and some children. Thuanus says he was the mot excellent and accomplished man of the age in which he lived; and all the learned have agreed to speak well of him. He collected a very valuable library, containing a variety of rare manuscripts, as well as printed books; and he took many precautions to hinder its being dispersed after his death, but in vain. He published a great number of works upon law, history, and classical literature; and he gave several new and correct editions of ancient writers. He was the first who made the world acquainted with the Fables of Phædrus: which, together with the name of their author, were utterly unknown and unheard of, till published from a manuscript of his.

PITISCUS, Samuel, a learned antiquary, was born at Zutphen, and was rector of the college of that city, and afterwards of St Jerome at Utrecht, where he died on the first of February 1717, aged 90. He wrote, 1. *Lexicon Antiquitatum Romanarum*, in two volumes folio; a work which is esteemed. 2. Editions of many Latin authors, with notes; and other works.

PITKEATHLY, or Pitcaithly, is the name of an estate in Strathern in Scotland, famous for its mineral waters. An intelligent traveller * gives the following account of it. "The situation of the mineral spring at Pitcaithly, the efficacy with which its waters are said to operate in the cure of the diseases for which they are used, and the accommodations which the neighbourhood affords, are all of a nature to invite equally the sick and the healthy. Two or three houses are kept in the style of hotels for the reception of strangers. There is no long-room at the well; but there are pleasing walks through the adjoining fields. Good roads afford easy access to all the circumjacent country. This delightful tract of Lower Strathern is filled with houses and gardens, and stations from which wide and delightful prospects may be enjoyed: all of which offer agreeable points to which the company at the well may direct their forenoon excursions; conversation, music, dances, whist, and that best friend to elegant, lively, and social converse, the tea-table, are sufficient to prevent the afternoons from becoming languid: and in the evenings nothing can be so delightful as a walk when the setting-sun sheds a soft slanting light, and the dew has just not begun to moisten the grass.—Thus is Pitcaithly truly a rural watering-place. The company cannot be at any one time more in number than two or three families. The amusements of the place are simply such as a single family might enjoy in an agreeable situation in the country: only the society is more diversified by the continual change and fluctuation of the company." The waters of this place are of a sulphureous nature.

PITOT, Henry, of a noble family in Languedoc, was born at Aramont in the diocese of Usez, on the 29th of May 1695, and died there on the 27th of December 1771, aged 76. He learned the mathematics without a master, and went to Paris in 1718, where he formed a close friendship with the illustrious Reaumur. In 1724, he was admitted a member of the Royal Academy of Sciences at Paris, and in a few years rose to the degree of a pensioner. Besides a vast number of Memoirs printed in the collection of that society, he published in 1731 the Theory of the Working of Ships, in one volume 4to; a work of considerable merit, which was translated into English, and made the author be admitted into the Royal Society of London. In 1740, the states-general of Languedoc made choice of him for their chief engineer, and gave him at the same time the appointment of inspector general of the canal which unites the two seas. That province is indebted to him for several monuments of his genius, which will transmit his name with lustre to posterity. The city of Montpellier being in want of water, Pitot brought from the distance of three leagues the water of two springs which furnish a plentiful supply of that necessary article. They are brought to the magnificent Place du Peyron, and thence are distributed through the city. This astonishing work is the admiration of all strangers. The illustrious marshal de Saxe was the great patron and friend of Pitot, who had taught this hero the mathematics. In 1754 he was honoured with the order of St Michael. In 1735, he had married Maria Leonina Pharambier de Sabballoua, descended of a very ancient noble family of Navarre. By this marriage he had only one son, who was first advocate-general of the court of accounts, aids, and finances of Montpellier. Pitot was a practical philosopher, and a man of uncommon probity and candour. He was also a member of the Royal Society of Sciences of Montpellier; and his eulogium was pronounced in 1772 by M. de Ratte perpetual secretary, in presence of the states of Languedoc; as it likewise was at the Royal Academy of Sciences of Paris by Abbé de Fouchi, who was then secretary.

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* Heron's *Journey through the Western Counties of Scotland.*

PITS, John, the biographer, was born in 1560, at Aulton in Hampshire, and educated at Wykeham's school, near Winchester, till he was about 18 years of age: when he was sent to New-college in Oxford, and admitted probationer fellow. Having continued in that university not quite two years, he left the kingdom as a voluntary Romish exile, and retired to Douay; thence he went to the English college at Rheims, where he remained about a year; and then proceeded to Rome, where he continued a member of the English college near seven years, and was made a priest. In 1589 he returned to Rheims; and there, during two years, taught rhetoric and the Greek language. He now quitted Rheims on account of the civil war in France; and retired to Pont à Mousson in Lorrain, where he took the degrees of master of arts and bachelor in divinity. Hence he travelled into Germany, and resided a year and a half at Triers, where he commenced licentiate in his faculty, From Triers he visited several of the principal cities in Germany; and continuing three years at Ingoldstadt in Bavaria, took the degree of doctor in divinity. Thence having made the tour of Italy, he returned once more to Lorrain; where he was patronised by the cardinal of that duchy, who preferred him to a canonry of Verdun; and about two years after he became confessor to the duchess of Cleves, daughter to the duke of Lorrain. During the leisure he enjoyed in this employment, he wrote in Latin the lives of the kings, bishops, apostolical men, and writers of England. The last of these, commonly known and quoted by this title, *De illustribus Angliæ scriptoribus*, was published after his death. The three first remain still in manuscript among the archives of the collegiate church of Liverdun. The duke of Cleves dying after Pits had been about twelve years confessor to the duchess, she returned to Lorrain, attended by our author, who was promoted to the deanery of Liverdun, which, with a canonry and officialship, he enjoyed to the end of his life. He died in 1616, and was buried in the collegiate church. Pits was undoubtedly a scholar, and not an inelegant writer; but he is justly accused of ingratitude to Bale, from whom he borrowed his materials, without acknowledgement. He quotes Leland with great familiarity, without ever having seen his book; his errors are innumerable, and his partiality to the Romish writers most obvious; nevertheless we are obliged to him for his account of several popish authors, who lived abroad at the beginning of the Reformation.

PITT, Christopher, an eminent English poet, celebrated for his excellent translation of Virgil's Æneid, was born in the year 1699. Having studied four years at New-college, Oxford, he was presented to the living of Pimperne in Dorsetshire, which he held during the remainder of his life. He had so poetical a turn, that while he was a school-boy he wrote two large folios of manuscript poems, one of which contained an entire translation of Lucan. He was much esteemed while at the university; particularly by the celebrated Dr Young, who used familiarly to call him his *son*. Next to his fine translation of Virgil, Mr Pitt gained the greatest reputation by his excellent English translation of Vida's Art of Poetry. This amiable poet died in the year 1748, without leaving, it is said, one enemy behind him.

Pitt, *William*, earl of Chatham, a most celebrated British statesmen and patriot, was born in November 1708. He was the youngest son of Robert Pitt, Esq. of Boconnock in Cornwall; and grandson of Thomas Pitt, Esq. governor of Fort St George in the East Indies, in the reign of Queen Anne, who sold an extraordinary diamond to the king of France for 135,000l. and thus obtained the name of *Diamond Pitt*. His intellectual faculties and powers of elocution very soon made a distinguished appearance; but at the age of 16 he felt the attacks of an hereditary and incurable gout, by which he was tormented at times during the rest of his life.

His lordship entered early into the army, and served in a regiment of dragoons. Through the interest of the duchess of Marlborough he obtained a seat in parliament before he was 21 years of age. His first appearance in the house was as representative of the borough of Old Sarum, in the ninth parliament of Great Britain. In the 10th he represented Seaford, Aldborough in the 11th, and the city of Bath in the 12th; where he continued till he was called up to the house of peers in 1766. The intention of the duchess in bringing him thus early into parliament was to oppose Sir Robert Walpole, whom he kept in awe by the force of his eloquence. At her death the duchess left him 10,000l. on condition, as was then reported, that he never should receive a place in administration. However, if any such condition was made, it certainly was not kept on his lordship's part. In 1746, he was appointed vice-treasurer of Ireland, and soon after paymaster general of the forces, and sworn a privy-counsellor. He discharged the office of paymaster with such honour and inflexible integrity, refusing even many of the perquisites of his office, that his bitterest enemies could lay nothing to his charge, and he soon became the darling of the people. In 1755 he resigned the office of paymaster, on seeing Mr Fox preferred to him. The people were alarmed at this resignation; and being disgusted with the unsuccessful beginning of the war, complained so loudly, that, on the 4th December 1756, Mr Pitt was appointed secretary of state in the room of Mr Fox afterwards Lord Holland; and other promotions were made in order to second his plans. He then took such measures as were necessary for the honour and interest of the nation; but in the month of February 1757, having refused to assent to the carrying on a war in Germany for the sake of his majesty's dominions on the continent, he was deprived of the seals on the 5th of April following. Upon this the complaints of the people again became so violent, that on the 29th of June he was again appointed secretary, and his friends filled other important offices. The success with which the war was now conducted is universally known; yet on the 5th of October 1761, Mr Pit, to the astonishment of almost the whole kingdom, resigned the seals into his majesty's own hands. The reason of this was, that Mr

Pitt, having received certain intelligence that the family-compact was signed between France and Spain, and that the latter was about to join France against us, thought it necessary to prevent her by commencing hostilities first. Having communicated this opinion in the privy-council, the other ministers urged that they would think twice before they declared war against that kingdom. "I will not give them leave to think (replied Mr Pitt); this is the time, let us crush the whole house of Bourbon. But if the members of this board are of a different opinion, this is the last time I shall ever mix in its councils. I was called into the ministry by the voice of the people, and to them I hold myself answerable for my conduct. I am to thank the ministers of the late king for their support; I have served my country with success; but I will not be responsible for the conduct of the war any longer than while I have the direction of it." To this bold declaration, the lord who then presided in council made the following reply. "I find the gentleman is determined to leave us; nor can I say that I am sorry for it, since he would otherwise have certainly compelled us to leave him. But if he is resolved to assume the right of advising his majesty, and directing the operations of the war, to what purpose are we called to this council? When he talks of being responsible to the people, he talks the language of the house of commons, and forgets that at this board he is responsible only to the king. However, though he may possibly have convinced himself of his infallibility, still it remains that we should be equally convinced before we can resign our understandings to his direction, or join with him in the measure he proposes."

This conversation, which was followed by Mr Pitt's resignation, is sufficient to show the haughtiness and imperious temper of our minister. However, these very qualities were sometimes productive of great and good consequences, as appears from the following anecdote. —Preparatory to one of the secret expeditions during the war which ended in 1763 the minister had given orders to the different presiding officers in the military, navy, and ordnance departments, to prepare a large body of forces, a certain number of ships, and a proportionable quantity of stores, &c. and to have them all ready against a certain day. To these orders he received an answer from each of the officers, declaring the total impossibility of a compliance with them. Notwithstanding it was then at a very late hour, he sent immediately for his secretary; and after expressing his resentment at the ignorance or negligence of his majesty's servants, he gave the following commands:— "I desire, Mr Wood, that you will immediately go to Lord Anson; you need not trouble yourself to search the admiralty, he is not to be found there; you must pursue him to the gaming-house, and tell him from me, that if he does not obey the orders of government, which he has received at my hands, that I will most assuredly impeach him. Proceed from him to Lord Ligonier; and though he should be bolstered with harlots, undraw his curtains, and repeat the same message. Then direct your course to Sir Charles Frederick, and assure him that if his majesty's orders are not obeyed, they shall be the last which he shall receive from me." In consequence of these commands, Mr Wood proceeded to White's, and told his errand to the first lord of the admiralty; who insisted that the secretary of state was out of his senses, and it was impossible to comply with his wishes: "however, (added he), as madmen must be answered, tell him that I will do my utmost to satisfy him." From thence he went to the commander in chief of the forces, and delivered the same message. He also said that it was an impossible business; "and the secretary knows it, (added the old lord): nevertheless, he is in the right to make us do what we can; and what it is possible to do, inform him, shall be done." The surveyor general of the ordnance was next informed of Mr Pitt's resolution; and, after some little consideration, he began to think that the orders might be completed within the time prescribed. The consequence at last was, that every thing, in spite of impossibilities themselves, was ready at the time appointed.

After his resignation in 1761, Mr Pitt never had any share in administration. He received a pension of 3000l. a-year, to be continued after his decease, during the survivancy of his lady and son; and this gratuity was dignified with the title of *Baroness of Chatham* to his lady, and that of *Baron* to her heirs male. Mr Pitt at that time declined the title of nobility; but in 1766 accepted of a peerage under the title of *Baron Pynsent and Earl of Chatham*, and at the same time he was appointed lord privy-seal.

This acceptance of a peerage proved very prejudicial to his lordship's character. However, he continued stedfast in his opposition to the measures of administration. His last appearance in the house of lords was on the 2d of April 1778. He was then very ill and much debilitated: but the question was important, being a motion of the duke of Richmond to address his majesty to remove the ministers, and make peace with America on any terms. His lordship made a long speech, which had certainly overcome his spirits: for attempting to rise a second time, he fell down in a convulsive fit; and though he recovered for that time, his disorder continued to increase till the 11th of May, when he died at his seat at Hayes. His death was lamented as a national loss. As soon as the news reached the house of commons, which was then sitting, Colonel Barré made a motion, that an address should be presented to his majesty, requesting that the earl of Chatham should be buried at the public expence. But Mr Rigby having proposed the erecting of a statue to his memory, as more likely to perpetuate the sense of his great merits entertained by the public, this was unanimously carried. A bill was soon after passed, by which 4000l. a-year was settled upon John now earl of Chatham, and the heirs of the late earl to whom that title may descend.— His lordship was married in 1754 to Lady Hester, sister to the earl of Temple; by whom he had three sons and two daughters.

Never perhaps was any life so multifarious as that of Lord Chatham; never did any comprise such a number of interesting situations. To bring the scattered features of such a character into one point of view, is an arduous task. The author of the history * of his life has attempted to do it; and with the outlines of what he has said in summing up his character, we shall finish our biographical sketch of this wonderful man.

"One of the first things that strikes us, in the recollection of Chatham's life, is the superior figure he makes among his contemporaries. Men of genius and attraction, a Carteret, a Townshend, and I had almost said a Mansfield, however pleasing in a limited view, appear evidently in this comparison to shrink into narrower dimensions, and walk a humbler circle. All that deserves to arrest the attention, in taking a general survey of the age in which he lived, is comprised in the history of Chatham. No character ever bore the more undisputed stamp of originality. Unresembled and himself, he was not born to accommodate to the genius of his age. While all around him were depressed by the uniformity of fashion, or the contagion of venality, he stood aloof. He consulted no judgment but his own; and he acted from the untainted dictates of a comprehensive soul.

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* *History of the Life of William Pitt, Earl of Chatham.*

"The native royalty of his mind is eminently conspicuous. He felt himself born to command; and the free sons of Britain implicitly obeyed him. In him was realised the fable of Orpheus; and his genius, his spirit, his eloquence, led millions in his train, subdued the rugged savage, and disarmed the fangs of malignity and envy. Nothing is in its nature so inconsistent as the breath of popular applause: and yet that breath was eminently his during the greater part of his life. Want of success could not divert it; inconsistency of conduct could not change its tenor. The astonishing extent of his views, and the mysterious comprehension of his plans, did not in one respect set him above little things: nothing that was necessary to the execution of his designs was beneath him. In another respect, however, he was infinitely estranged to little things: swallowed up in the business of his country, he did not think of the derangement of his own private affairs; for, though indisposed to all the modes of dissipated expence, his affairs, even when his circumstances were much improved, were always deranged. But the features that seem most eminently to have characterised him, were spirit and intrepidity: they are conspicuous in every action and in every turn of his life; nor did this spirit and intrepidity leave him even at the last.

"The manners of Lord Chatham were easy and bland, his conversation was spirited and gay, and he readily adapted himself to the complexion of those with whom he associated. That artificial reserve, which is the never-failing refuge of self-diffidence and cowardice, was not made for him. He was unconstrained as artless infancy, and generous as the noon-day sun: yet had he something impenetrable that hung about him. By an irresistible energy of soul, he was haughty and imperious. He was incapable of associating councils, and he was not formed for the sweetest bands of society. He was a pleasing companion, but an unpliant friend.

"The ambition of our hero, however generous in its strain, was the source of repeated errors in his conduct. To the resignation of Lord Carteret, and again, from the commencement of the year 1770, his proceedings were bold and uniform. In the intermediate period they were marked with a versatility, incident only in general to the most flexible minds. We may occasionally trace in them the indecision of a candidate, and the suppleness of a courtier. In a word, he aimed at the impossible task of flattering at once the prejudices of a monarch, and pursuing unremittedly the interests of the people.

"A feature, too, sufficiently prominent in his character, was vanity, or perhaps pride and conscious superiority. He dealt surely somewhat too freely with invective. He did not pretend to an ignorance of his talents, or to manage the display of his important services. Himself was too often the hero of his tale; and the successes of the last war the burden of his song *.

"Patriotism was also the source of some of his imperfections. He loved his country too well; or, if that may sound absurd, the benevolence at least, that embraces the species, had not sufficient scope in his mind. He once styled himself *a lover of honourable war;* and in so doing he let us into one trait of his character. The friend of human kind will be an enemy to all war. He indulged too much a puerile antipathy to the house of Bourbon: and it was surely the want of expansive affections that led him to so unqualified a condemnation of American independency.

"But the eloquence of Lord Chatham was one of his most striking characteristics. He far outstripped his competitors, and stood alone the rival of antiquity.

"His eloquence was of every kind. No man excelled him in close argument and methodical deduction: but this was not the style into which he naturally fell. His oratory was unlaboured and spontaneous: he rushed at once upon the subject; and usually illustrated it rather by glowing language and original conception, than by cool reasoning. His person was tall and dignified; his face was the face of an eagle; his piercing eye withered the nerves, and looked through the souls of his opponents; his countenance was stern, and the voice of thunder sat upon his lips: anon, however, he could descend to the easy and the playful. His voice seemed scarcely more adapted to energy and to terror, than it did to the melodious, the insinuating, and the sportive. If, however, in the enthusiasm of admiration, we can find room for the frigidity of criticism, his action seemed the most open to objection. It was forcible, uniform, and ungraceful. In a word, the most celebrated orators of antiquity were in a great measure the children of labour and cultivation. Lord Chatham was always natural and himself."

To the misfortune of letters, and of posterity, it has been said, his lordship never published any thing. Lord Chesterfield says, "that he had a most happy turn for poetry; but it is more than probable that Chesterfield was deceived; for we are told by his biographer that his verses to Garrick were very meagre, and Lord Chatham himself said that he seldom indulged and seldom avowed it. It should seem, then, that he himself set no great value upon it. Perhaps a proper confidence of one's self is essential to all extraordinary merit. Why should we ambitiously ascribe to one mind every species of human excellence? But though he was no poet, it is more than probable, that he would have excelled as much in writing prose as he did in speaking it.

PITT, *the Right Honourable William*, was the fourth child of that illustrious orator and consummate statesman, William Pit, the first earl of Chatham, and was born on the 28th of May 1759. Nicholas Pitt, who lived in the reign of Henry VI. was the common ancestor of the noble families of Chatham, Camelford, and Rivers. Thomas Pitt, the first of the name who attained any considerable eminence, was governor of Fort St George in the East Indies, where he purchased, as noticed in the preceding life, for 20,400l. sterling, the extraordinary diamond called the *regent*, weighing 127 carats, and which was sold to the king of France for the enormous sum of 135,000l. sterling. The diamond it is said, now occupies a conspicuous place in the imperial diadem of Bonaparte,

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* Ending in 1763.

Bonaparte. By means of this vast sum he was enabled to purchase a considerable estate in Cornwall; yet his grand-children were poorly provided for, particularly the great earl of Chatham, but what he wanted in opulence was abundantly supplied by the uncommon talents and abilities, which nature conferred upon him in the profusest manner. Although he betook himself for support to the profession of arms, he never rose higher than to the rank of a cornet of horse, of which Sir Robert Walpole, with unexampled meanness, deprived him, because he had the boldness and integrity to oppose his administration. This, however, proved no real obstacle to his preferment in the state, for in the year 1756 he became prime minister.

As the present earl of Chatham was destined for the army, and another son James-Charles for the navy, lord Chatham resolved to train up William to the profession of a statesman. Having therefore confided the care of his other two sons to others, he took William under his own immediate inspection, whose rapid progress cheered the solitude, and illumed the declining days of this extraordinary man, who already began to presage his future greatness. His school exercises were performed under the care of a private tutor, a Mr, afterwards Dr Wilson, while his noble father embraced every opportunity of conversing with him on every interesting topic with the utmost freedom, in order to expand his mind, and mature his judgment. He also made him declaim from a chair or a table, well knowing that the gift of eloquence is a valuable acquisition for a young man who wishes to arrive at eminence, and that it had supplied the deficiencies of fortune in his own person.

It was resolved on, at a proper period, to send William to one of the universities, and on this occasion Cambridge was preferred to Oxford, from a decided opinion entertained by many, that the political doctrines inculcated at the former were more liberal than those usually propagated at the latter. He was accordingly placed under the tuition of Dr Turner of Pembroke Hall. Dr Prettyman, afterwards bishop of Lincoln, also participated in the care of his education, and was his private instructor. During his residence at Cambridge, it appears certain that the morals and conduct of Mr Pitt were unimpeachable, not in the smallest degree contaminated by the powerful example of the young nobility. Here he took his bachelor's degree, and also that of A. M. and acquired such reputation in the university for talents, industry, and propriety of deportment, as proved of great advantage to him in his subsequent pursuits through life.

When Mr Pitt left the university, he was entered at Lincoln's Inn, much about the same time with Mr Addington, whose father had been both the physician and friend of his family, and was enabled to be called to the bar in the space of three years, having received some marks of favour on account of his degree. He made choice of the western circuit as the scene of his first efforts; but having little practice as a lawyer, he had of consequence but little celebrity; and it is probable that he was ill qualified, on the score of patient and laborious investigation, for a pursuit in which nothing great can be accomplished, without the persevering industry of a whole life.

Fortune at this time seemed eager to heap favours upon him of another kind. Being bred a statesman, the house of commons was of course the place where he was to begin his political career. He was advised by numerous friends to propose himself a candidate for the university of Cambridge, but he failed of success from the want of sufficient influence. Accident, however, brought about what the designs of his friends could not accomplish. The duke of Rutland asked Sir James Lowther (afterwards earl of Lonsdale), if he could possibly make room in any of his boroughs, to bring in his young friend Mr Pitt, who had thus lost his election for Cambridge. He was chosen member for the borough of Appleby. About this time the American war was raging with unabated violence, which Mr Pitt, following the example and advice of his father, reprobated as one of the most shameful and ruinous conflicts of modern times. Having espoused the constitutional and popular side of this important question, his opening talents were displayed to no common advantage, and he was not only regarded as a promising speaker, but destined at some future period to rank high in the councils of his native country. This was truly honourable to so young a man, when it is remembered that one house could then boast of a Rockingham, a Richmond, and a Shelburne, and the other of a Saville, a Dunning, a Burke, a Barré, and a Fox. Yet there was still room for our juvenile orator, and the recollection of the eloquence, the talents, and the meritorious services of his father, contributed greatly to fix the attention of mankind on the deportment of a favourite son.

About this time the extent of the royal prerogative engaged the attention both of the parliament and the public, and a vote of the commons, "that the influence of the crown had increased, was increasing, and ought to be diminished," plainly pointed to an object, whether real or imaginary, which occasioned a considerable degree of discontent. Mr Burke, then in the zenith of his popularity, encouraged by numerous symptoms of jealousy, once more brought forward his plan of economy, which being founded on a progressive retrenchment, appeared admirably calculated to diminish the influence of the crown. It is needless to add that it was opposed by the minister (Lord North), but it was ably supported by Mr Pitt, who forcibly ridiculed every objection that could be brought against it. The bill was rejected after a long debate, but afterwards introduced at a more auspicious period, and to a certain extent carried into effect.

Mr Fox having moved that ministers should immediately take every possible measure for concluding a peace with our American colonies, he was powerfully supported by Mr Pitt, whose commanding eloquence engaged the whole attention of the house, while he reprobated the cruelty and impolicy of the contest with our colonies. He declared that it was conceived in injustice, nurtured and brought forth in folly, and its footsteps were marked with blood, slaughter, persecution, and devastation. Many handsome compliments were paid him by two eminent judges of real merit, we mean the lord advocate of Scotland (now Viscount Melville), and Mr Wilkes. The former, in particular, declared that his powerful abilities and brilliant eloquence were universally acknowledged proofs, that the astonishing extent and force of an exalted understanding had descended, in an hereditary line, from the late illustrious possessor of them, to a son equally endowed with all the fire, and strength, and grace of oratory.

A more equal representation of the people in parliament was one of the principal objects to which the nation directed its attention, next to the American war. It was admitted to be the undoubted prerogative of the crown to declare war; but as the supplies were entrusted to the management of the representatives of the people, it was affirmed by some that ministers could not have carried on a contest accompanied with the waste of so much blood and treasure, had it not been owing to the corruption and venality of parliament. To derive advantage from past experience; to confer on the people their due importance in such a mixed government as that of Britain, and restore the constitution to its original purity, became by this time the grand object of Mr Pitt's exertions. He was as yet untainted by the fascinating charms of power and authority, and considered a well-earned fame as the best, the only reward of his laudable endeavours. He accordingly brought the principles and conduct of his opponents to such a test as they successfully employed against himself, in order to wound his feelings, and convict him of inconsistency, by turning his back on his once favourite sentiments. When many cities and counties endeavoured to obtain a reform in parliament, Mr Pitt actually sat in a convention of delegates, met together in the neighbourhood of the place where the legislature held its sittings.

The American war in the mean time was drawing to a termination, and the spoils of the office of the former minister became the reward of those who opposed him. During the short existence of the Rockingham administration, contractors were excluded from the house of commons; officers belonging to the customs and excise were declared unqualified to vote at elections; the proceedings respecting the Middlesex election were rescinded: and while a more liberal policy was adopted with regard to Ireland, many superfluous offices were abolished in England by means of a reform bill, which tended powerfully to destroy corruption. Many more important reforms would have been accomplished, had not the death of the distinguished Rockingham brought about great and sudden changes.

Mr Fox retired in consequence of new arrangements, and Lord Shelburne, as first lord of the treasury, made choice of Mr Pitt as chancellor of the exchequer, who declared, although only 23 years of age, that he would accept of no inferior office. Peace now seemed to be an object generally desireable at any rate, and without much regarding what sacrifices might be made in order to procure it; but the terms met with powerful opposition from two men formerly considered as mortal enemies, viz. Lord North and Mr Fox, the latter of whom retired from office. Soon after the dismission of Mr Fox, Mr Pitt again brought forward the question respecting a reform in parliament, which he fondly hoped would be the means of restoring him to his wonted popularity, and pave the way to the increase of his power. He therefore submitted three different motions to the consideration of the house; but although in these motions he was ably supported, he was left in a minority.

The coalition ministry, as it was called, had still a considerable majority in parliament, notwithstanding the popularity belonging to the name and talents of Mr Pitt, but the celebrated India bill was productive of a change. This bill owed its origin to Mr Burke, but it received a regular and systematical opposition from the ex-chancellor of the exchequer. It was carried, however, in the house of commons by a great majority, but in the house of lords it was opposed by the duke of Richmond, Lord Thurlow, and Earl Temple (afterwards marquis of Buckingham); and on the 17th of December 1783, it was finally rejected by a majority of 19.

The king in the mean time determined on an entire change of administration, and the two secretaries were informed on the 18th of December 1783, about 12 o'clock at night, that his majesty had no further occasion for their services. In consequence of this change, the important offices of first lord of the treasury and chancellor of the exchequer were bestowed on Mr Pitt, who thus became prime minister before he was full 24 years of age. Thurlow was created lord chancellor, the duke of Richmond keeper of the privy seal; the marquis of Caermarthen and Lord Sidney were chosen secretaries of state, and Mr Dundas, treasurer of the navy.

Much about this time Mr Pitt brought forward a new bill for the better government of India. He proposed that a board of controul should be instituted, the nomination of whose members was to be vested in the crown, and to them the dispatches of the company were to be submitted. He also proposed that the appointment of the commander in chief should belong to his majesty, and having thus secured the political interests of the company, he left those of a commercial nature entirely to the court of directors. This bill, after a short debate, was rejected by a majority of eight. Such was the present temper of the house of commons, that a coalition or immediate dissolution became absolutely necessary; and the former having been unsuccessfully attempted, the latter was suddenly adopted, on the 25th of March 1784. Mr Pitt having been returned for the university of Cambridge, again brought forward his bill in an amended state for the regulation of India, and carried it in triumph through both houses of parliament. The remaining part of the session gave birth to an act for the better prevention of smuggling, and the commutation act, by virtue of which certain duties were transferred from tea to windows.

When Mr Alderman Sawbridge (June 16th 1784) made a motion for inquiring into the present state of the commons of Great Britain in parliament, Mr Pitt, whose political sentiments had undergone a revolution, felt himself considerably embarrassed, as he was reminded that he had brought forward questions on the same subject upon a former occasion. Mr Pitt, however, declined it, on account of the pressure of public business, and observed that, in his opinion, the present was not the proper time for bringing forward the question, and that it might be urged with greater probability of success on some future occasion. He did not wish it to be discussed in a precipitate manner, yet the business itself should have every support he was able to afford it.

Having now attained the summit of power and influence as prime minister, Mr Pitt exercised every function of his important office, without any check or controul. Possessed of a great majority in both houses of parliament, as well as in the cabinet, his whole deportment in the language of his opponents, seems to have become lofty in the extreme; and he paid little or no regard to that popularity which he had formerly courted.

A commercial treaty about this time was entered into with France, the terms of which have been generally acknowledged to be advantageous to Britain. Mr Pitt, who deserves great credit for giving the plan his countenance, adopted, much about the same time, another respecting the finances, from which he derived a high degree of reputation; and, as he pointed at a period when the national debt might, in all probability, be extinguished, the country, if it was not altogether satisfied, appeared to be at least contented under his administration: and it is not a little to the credit of his financial system, that his opponents, when in power, not only approved, but adopted and extended it.

In this manner a commercial country began again to flourish, by turning its attention to the arts of peace; but, during his administration, its prosperity was threatened to be interrupted by the preparation for an attack upon Russia at one time, and by an open rupture with Spain at another, relative to Nootka Sound. In both cases the blow was warded off by negociation, and a good understanding restored. The restoration of the stadtholder, by the intervention of a Prussian army, and his strenuous opposition of the prince of Wales's appointment to the regency during the king's indisposition, were also two important measures pursued and discussed in the course of his ministry.

Soon after the commencement of the French revolution, Mr Pitt deemed a war with that country inevitable. But for a full detail of the events of this war, see BRITAIN. Having held the reins of government during 18 years, Mr Pitt, and all the members of the cabinet, suddenly retired from office in 1801. On this occasion all parties appeared to rejoice at the appointment of Mr Addington; and France, from that moment, as some assert, seemed to have neither friends nor advocates in this island. When the articles of the treaty of Amiens were debated in the house of commons, Mr Pitt defended the new minister with the whole force of his abilities and influence.

On the 15th of March 1804, Mr Pitt made a direct attack on the administration; and the admiralty board was accused by him of imbecility. He zealously supported Mr Fox's proposition relative to the Irish militia bill for the national defence, which was lost on a division. The minister's majority having dwindled to 37, on the army of reserve suspension bill, Mr Addington and some of his friends retired, and the ex-minister resumed his former seat. When parliament met on the 15th of January 1805, Mr Pitt warmly defended the war with Spain; and, on the motion for an address, he had a majority of 207.

But, in the mean time, a gouty habit, the predisposing causes of which appear to have been hereditary, and which, perhaps, was increased by his own manner of living, seized on a constitution never very strong. It is alleged, by his opponents, that this, combined with the miscarriage of his schemes, and the aspect of affairs on the continent, preyed so much upon his mind, that he is said to have died of a broken heart, at his house near Putney, between four and five on Wednesday morning, January 23. 1806, in the 47th year of his age.

As a financier, no man has obtained more praise, who ever presided at the board of exchequer. During his ministry some of our manufactures languished, but many flourished, and our exports were greatly increased. As a speaker he was unrivalled, and his generous scorn of wealth must be admired. In 20 years his debts amounted only to 40,000l. They were paid out of the public purse. The house of commons also passed a vote, that the expences of his funeral, and a monument to his memory, should be defrayed by the nation.

PITTACUS, a native of Mitylene in Lesbos, was one of the seven wise men of Greece: his father's name was Hyrradius. With the assistance of the sons of Alcæus, he delivered his country from the oppression of the tyrant Melanchrus; and in the war which the Athenians waged against Lesbos, he appeared at the head of his countrymen, and challenged to single combat Phrynon the enemy's general. As the event of the war seemed to depend upon this combat, Pittacus had recourse to artifice; and when he engaged, he entangled his adversary in a net which he had concealed under his shield, and easily dispatched him. He was amply rewarded for this victory; and his countrymen, sensible of his merit, unanimously appointed him governor of their city with unlimited authority. In this capacity Pittacus behaved with great moderation and prudence; and after he had governed his fellow-citizens with the strictest justice, and after he had established and enforced the most salutary laws, he voluntarily resigned the sovereign power after having enjoyed it for 10 years, observing that the virtues and innocence of private life were incompatible with the power and influence of a sovereign. His disinterestedness gained him many admirers; and when the Mityleneans wished to reward his public services by presenting him with an immense tract of territory, he refused to accept more land than what should be contained in the distance to which he he could throw a javelin. He died in the 70th year of his age, about 579 years before Christ, after he had spent the last 10 years of his life in literary ease and peaceful retirement.

The following maxims and precepts are ascribed to Pittacus: The first office of prudence is to foresee threatening misfortunes, and prevent them. Power discovers the man. Never talk of your schemes before they are executed; lest, if you fail to accomplish them, you be exposed to the double mortification of disappointment and ridicule. Whatever you do, do it well. Do not that to your neighbour which you would take ill from him. Be watchful for opportunities.

Many of his maxims were inscribed on the walls of Apollo's temple at Delphi, to show to the world how great an opinion the Mityleneans entertained of his abilities as a philosopher, a moralist, and a man. By one of his laws, every fault committed by a man when intoxicated deserved double punishment.

PITTENWEEM, a small town situated on the frith of Forth, towards the eastern extremity of the county of Fife in North Britain. It takes its name from a small cave in the middle of it, anciently called a *weem*; and is remarkable for nothing but the ruins of a religious house, which is sometimes called an *abbey* and sometimes a *priory*. Which of these is the proper denomination it is hardly worth while to inquire; but it appears from the arms of the monastery, still preserved over the principal gate, that the superior, by whatever title he was called, had the privilege of wearing a mitre. This edifice, which seems never to have been large, was, with other monuments of mistaken piety, alienated from the church at the Reformation; and what parts of it now remain are put to very different uses. Some of the cells of the monks furnish habitations tolerably convenient for the servants of him who, in the ceaseless change of property, has got possession of the lands which formerly belonged to them. That which seems to have been the granary is a decent parish church. The porch of the chapel, the only part of that building which exists, has been alternately employed as a stable and a slaughter-house; and the meat killed there has been commonly exposed to sale in the lower part of the steeple of that edifice which is now dedicated to the offices of parochial devotion. Had the moralizing traveller *, who composed the beautiful and pathetic meditation on the ruins of *Jona*, condescended to visit Pittenweem, he would not have viewed the abbey without emotion. Insignificant as the place at present is, it seems to have been of some consequence in the last century; and we are led to infer, from the following extract from the records, that the inhabitants were opulent, and that the town was fortified.

"Pittenweem, decimo quarto Feb. 1651. The bailies and council being convened, and having received information that his majesty is to be in progress with his court along the coast to-morrow, and to stay at Anstruther house that night, have thought it expedient, according to their bounden duty, with all reverence and due respect, and with all the same solemnity they can, to wait upon his majesty, as he comes through this his majesty's burgh, and invite his majesty to eat and drink as he passes; and for that effect hath ordained, that the morn afternoon the town's colours be put upon the bertisene of the steeple, and that at three o'clock the bells begin to ring, and ring on still till his majesty comes hither, and passes to Anstruther: And sicklike, that the minister be spoken to, to be with the bailies and council, who are to be in their best apparel, and with them a guard of 24 of the ablest men, with partizans, and other 24 with muskets, all in their best apparel, William Sutherland commanding as captain of the guard; and to wait upon his majesty, and to receive his highness at the West Port, bringing his majesty and court through the town, until they come to Robert Smith's yeet, where an table is to be covered with my Lord's † best carpet: and that George Hetherwick have in readiness, of fine flour, some great bunns, and other wheat-bread of the best order, baken with sugar, cannell, and other spices fitting; and that James Richardson and Walter Airth have care to have ready eight or ten gallons of good strong ale, with Canary, sack, Rhenish wine, tent, white and claret wines, that his majesty and his court may eat and drink; and that in the mean time, when his majesty is present, the guard do diligently attend about the court; and so soon as his majesty is to go away, that a sign be made to Andrew Tod, who is appointed to attend the colours on the steeple head, to the effect he may give sign to those who attend the cannon of his majesty's departure, and then the *hail thirty six cannons to be all shot at once*. It is also thought fitting, that the minister and James Richardson the oldest bailie, when his majesty comes to the table, show the great joy and sense this burgh has of his majesty's condescendence to visit the same, with some other expressions of loyalty. All which was acted." The population of this town, in 1790, was computed at 1157. N. Lat. 56. 11. W. Long. 2. 49.

PITTOSPORUM, a genus of plants belonging to the pentandria class. See BOTANY *Index*.

PITUITARY GLAND. See ANATOMY *Index*.

PITYOCAMPASIS, in *Entomology*, the caterpillar of the pine-tree, received its compound name from that substance. It was considered as a poison, and as a remedy, according to its different mode of application. Our chief information, concerning this caterpillar, is derived from M. Reaumur, who has attentively observed its manner of life. The animal cannot bear much cold, and is therefore never found in the higher latitudes. It is styled processionary, because it never leaves its hold, where many families reside, till the evening, when it feeds in trains, led on by two or three, and this train leaves a ribband of silk in its way; for those behind follow exactly the steps of those which preceded, and each leaves its fibre of silk. Their nests are found in autumn; they are produced in the middle of September, become torpid in December, and recover their strength again in spring. They then descend from the trees, plunge into the earth, and undergo their last change. It is the bombix pityocampa of Fabricius, (*Mantissa Insector*. tom. ii. p. 114. N° 66.), and greatly resembled the processionary caterpillar of the oak. The ancients used it as a vesicatory, and the acrimony seems to reside chiefly in a dust which is concealed in receptacles on its back. This is its offensive weapon, for it is thrown out at will, and produces very troublesome effects, though the hair of the animal and every part of its body seem to have a similar, but weaker power. The effect is also weaker in winter; but this may depend on the diminished irritability of the human body, as well as on the torpid state of the insect. Their silk is not sufficiently strong for the loom, and in hot water melts almost to a paste. In the earth it forms nests of stronger silk, but it is then found with difficulty: in boxes its silk is extremely tender. Adding to all these inconveniences, handling the cones produces all the bad effects of the dust. Matthiolus recommends them as a styptic, and perhaps they may serve for burning on the skin, instead of moxa the downy silk of a species of artemisia. The ancients, afraid of its hurtful qualities, used them with caution, and enacted laws against their being sold promiscuously: the modern planter is chiefly afraid of them, because they destroy the beauty of his trees, and he endeavours to collect the eggs by cutting off the branches which are burnt immediately.

PIVAT, or PIVOT, a foot or shoe of iron or other metal, usually conical or terminating in a point, whereby a body, intended to turn round, bears on another fixed at rest, and performs its revolutions. The pivot usually bears or turns round in a sole, or piece of iron or brass hollowed to receive it.

PIUS II. (ÆNEAS SYLVIUS PICCOLOMINI), was born on the 18th of October 1405, at Corsigni in the Siennese, the name of which he afterwards changed into that of *Pienza*. His mother Victoria Forteguerra, when she was with child of him, dreamed that she should be delivered of a mitred infant; and as the way of degrading clergymen at that time was by crowning them with a paper mitre, she believed that Æneas would be a disgrace to his family. But what to her had the appearance of being a disgrace, was a presage of the greatest honours. Æneas was carefully educated, and made considerable proficiency in the belles lettres. After having finished his studies at Sienna, he went in 1431 to the council of Bale with Cardinal Capranica, surnamed *De Fermo*, because he was entrusted with the government of that church. Æneas was his secretary, and was then only 26 years of age. He afterwards acted in the same capacity to some other prelates, and to Cardinal Albergati. The council of Bale honoured him with different commissions, in order to recompense him for the zeal with which he defended that assembly against Pope Eugene IV. He was afterwards secretary to Frederic III. who decreed to him the poetic crown, and sent him ambassador to Rome, Milan, Naples, Bohemia, and other places. Nicholas V. advanced him to the bishopric of Trieste, which he quitted some time after for that of Sienna. At last, after having distinguished himself in various nunciatures, he was invested with the Roman purple by Calixtus III. whom he succeeded two years after, on the 27th of August 1458. Pius II. now advanced to the holy see, made good the proverb, *Honores mutant mores.* From the commencement of his pontificate, he appeared jealous of the papal prerogatives. In 1460 he issued a bull, "declaring appeals from the pope to a council to be null, erroneous, detestable, and contrary to the sacred canons." That bull, however, did not prevent the procurator-general of the parliament of Paris from appealing to a council in defence of the Pragmatic Sanction, which the pope had strenuously opposed. Pius was then at Mantua, whither he had gone in order to engage the Catholic princes to unite in a war against the Turks. The greater part of them had agreed to furnish troops or money; others refused both, particularly France, who from that moment incurred his holiness's aversion. That aversion abated under Louis XI. whom he persuaded in 1461 to abolish the Pragmatic Sanction, which the parliament of Paris had supported with so much vigour.

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* Johnson.

† The Earl of Kelly.

The following year, 1462, was rendered famous by a controversy which took place between the Cordeliers and Dominicans, whether or not the blood of Jesus Christ was separated from his body while he lay in the grave. It was also made a question whether it was separated from his divinity. The Cordeliers affirmed that it was, but the Dominicans were of an opposite opinion. They called each other heretics; which obliged the pope to issue a bull, forbidding them under pain of censure to brand one another with such odious epithets. The bull which his holiness published on the 26th of April, retracting what he had written to the council of Bale when he was its secretary, did not redound much to his honour. "I am a man (says he), and as a man I have erred. I am far from denying that a great many things which I have said and written may deserve condemnation. Like Paul, I have preached through deception, and I have persecuted the church of God through ignorance. I imitate the blessed Augustin, who having suffered some erroneous sentiments to creep into his works, retracted them. I do the same thing; I frankly acknowledge my ignorance, from a fear lest what I have written in my younger years should be the occasion of any error that might afterwards be prejudicial to the interests of the holy see. For if it be proper for any one to defend and support the eminence and glory of the first throne of the church, it is in a peculiar manner my duty, whom God, out of his mercy and goodness alone, without any merit on my part, has raised to the dignity of *vicar of Jesus Christ*. For all these reasons, we exhort and admonish you in the Lord, not to give credit to those writings of ours which tend in any degree to hurt the authority of the apostolic see, and which establish opinions that are not received by the Roman church. If you find, then, any thing contrary to her doctrine, either in our dialogues, in our letters, or in other of our works, despise these opinions, reject them, and adopt our present sentiments. Believe me rather now that I am an old man, than when I addressed you in my earlier days. Esteem a sovereign pontiff more than a private person; except against Æneas Sylvius, but receive Pius II." It might be objected to his holiness, that it was his dignity alone which had made him alter his opinion. He anticipates that objection, by giving a short account of his life and actions, with the whole history of the council of Bale, to which he went with Cardinal Capranica in 1431; "but (says he) I was then a young man, and without any experience, like a bird just come from its nest." In the mean time, the Turks were threatening Christendom. Pius, ever zealous in the defence of religion against the infidels, forms the resolution of fitting out a fleet at the expence of the church, and of passing over into Asia himself, in order to animate the Christian princes by his example. He repaired to Ancona with a design to embark; but he there fell sick with the fatigue of the journey, and died on the 16th of August 1464, aged 59 years. Pius was one of the most learned men of his time, and one of the most zealous pontiffs; but being of an ambitious and pliant disposition, he sometimes sacrificed to that ambition. His principal works are, 1. Memoirs of the council of Bale, from the suspension of Eugenius to the election of Felix. 2. The history of the Bohemians, from their origin to the year 1458. 3. Two books on cosmography. 4. The history of Frederic III. whose vice-chancellor he had been. This performance was published in 1785 in folio, and is believed to be pretty accurate and very particular. 5. A treatise on the education of children. 6. A poem upon the passion of Jesus Christ. 7. A collection of 432 letters, printed at Milan, 1473, in folio, in which are found some curious anecdotes. 8. The memoirs of his own life, published by John Gobelin Personne his secretary, and printed at Rome in 4to in 1584. There is no doubt of this being the genuine production of that pontiff. 9. *Historia rerum ubicumque gestarum*, of which only the first part was published at Venice in 1477 in folio. His works were printed at Helmstadt in 1700. in folio, at the beginning of which we find his life. That verse of Virgil's Æneid (lib. i. 382.) which begins thus,

Sum Pius Æneas,——

and the end of the following verse,

——*fama super æthera notus,*

have been applied to him.

Pius IV. (*John Angel, Cardinal de Medicis*), of a different family from that of Florence, was born at Milan in 1499. He was son to Bernardin de Medechini, and brother of the famous Marquis de Marignan. Charles V.'s general. He raised himself by his own merit, and filled several important offices under Popes Clement VII. and Paul III. Julius III. who had entrusted him with several legations, honoured him with a cardinal's hat in 1549. After the death of Paul IV. he was advanced to at Peter's chair on the 25th of December, 1559. His predecessor had rendered himself detestable to the Romans, who treated his memory with every mark of indignity, and Pius IV. commenced his pontificate by pardoning them. He did not, however extend the same clemency to the nephews of Pope Paul IV.; for he caused Cardinal Caraffe to be strangled in the castle of St Angelo, and his brother, the prince de Palliano, to be beheaded. His zeal was afterwards directed against the Turks and heretics. In order to stop, if possible, the progress of these last, he renewed the Council of Trent, which had been suspended. He knew well (says abbè de Choisy), that that council might make some regulations which would have the effect to lessen his authority; but, on the other hand, he perceived that great inconveniences might result from its not being assembled; and "*in the main* (said he to his confidants) *it is better to feel evil for once than to be always in dread of it.*" In 1561 he dispatched nuncios to all the Catholic and Protestant princes, to present them with the bull for calling that important assembly. An end was, however, put to it by the industry of his nephew, S. Charles Borromeus in 1563; and on the 26th of January the year following, he issued a bull for confirming its decrees. In 1565 a conspiracy was formed against his life by Benedict Acolti, and some other visionaries. Those madmen had taken it into their head that Pius IV. was not a lawful pope, and that after his death they would place another in St Peter's chair, with the title of *Pope Angelicus*, under whom errors might be reformed, and peace restored to the church. The conspiracy was discovered, and the fanatic Benedict put to death. This pontiff died a little time after, on the 9th of December 1565, aged 66 years, carrying to the grave with him the hatred of the Romans, whom his severities had exasperated. He was a man of great address, and very fruitful in his resources. He adorned Rome with several public edifices; but these ornaments tended greatly to impoverish it. If he was the instrument of raising his relations in the world, it must be allowed, at least, that the greater part of them did him honour.

Pius V. (*S. Michael Ghisleri*), born at Boschi or Bosco, in the diocese of Tortona, on the 17th of January 1504, was, according to Abbé de Choisy, son to a senator of Milan. He turned a Dominican friar. Paul IV. informed of his merit and virtue, gave him the bishopric of Sutri, created him cardinal in 1557, and made him inquisitor-general of the faith among the Milanese and in Lombardy; but the severity with which he exercised his office obliged him to quit that country. He was sent to Venice, where the ardour of his zeal met with still greater obstacles. Pius IV. added to the cardinal's hat the bishopric of Mondovi. After the death of that pontiff he was advanced to St Peter's chair in 1566. The Romans expressed but little joy at his coronation: he was very sensible of it, and said, "*I hope they will be as sorry at my death as they are at my election;*" but he was mistaken. Raised by his merit to the first ecclesiastical preferment in Christendom, he could not divest himself of the severity of his character; and the situation in which he found himself rendered, perhaps, that severity necessary. One of his first objects was to repress the luxury of the clergy, the pride of the cardinals, and the licentious manners of the Romans. He caused the decrees of reformation enacted by the Council of Trent to be put in execution; he prohibited bull-baiting in the Circus; he expelled from Rome the women of the town; and allowed the cardinals to be prosecuted for their debts. The errors which overflowed the Christian world gave him great uneasiness. After having employed gentle and lenient measures in the reclaiming of heretics, he had recourse to severity, and some of them ended their days in the flames of the inquisition. He particularly displayed his zeal for the grandeur of the holy see in 1568, by ordaining that the bull *In cœna domini*, which was published at Rome every year on *Maunday Thursday*, and which Clement XIV. suppressed, should be published likewise throughout the whole church. That bull, the work of several sovereign pontiffs, principally regards the jurisdiction of the ecclesiastical and civil power. It anathematizes those who appeal from the decrees of popes to a general council; those who favour the appellants; the universities which teach that the pope is subject to a general council; the princes who would restrain the ecclesiastical jurisdiction, or who exact contributions from the clergy. It was rejected by all the sovereign states, excepting a very few. In 1580, some bishops having endeavoured to introduce it into their dioceses, the parliament caused their temporalities to be seized upon, and declared those guilty of high treason who should imitate the fanaticism of those prelates. Pius V. for some time meditated an expedition against the Turks. He had the courage to make war on the Ottoman empire, by forming a league with the Venetians and Philip II. king of Spain. This was the first time that the standard of the two keys was seen displayed against the crescent. The naval armies came to an engagement, on the 7th of October 1571, in Lepanto bay, in which the confederate Christian princes obtained a signal victory over the Turks, who lost above 30,000 men, and near 200 galleys. This success was principally owing to the pope, who exhausted both his purse and person in fitting out that armament. He died of the gravel six months after, on the 30th of April 1572, aged 68. He repeated often, in the midst of his sufferings, "*O Lord! increase my pains and my patience.*" His name will for ever adorn the list of Roman pontiffs. It is true, that his bull against Queen Elizabeth, and his other bull in favour of the inquisition, with his rigorous prosecution of heretics both in France and Ireland, prove that he had more zeal than sweetness in his temper; but in other respects he possessed the virtues of a saint and the qualities of a king. He was the model of the famous Sixtus Quintus, to whom he gave an example of amassing in a few years such savings as were sufficient to make the holy see be regarded as a formidable power. Sultan Selim, who had no greater enemy than this pope, caused public rejoicings to be made at Constantinople for his death during the space of three days. The pontificate of Pius is also celebrated for the condemnation of Baius, the extinction of the order of Humilies, and the reformation of that of the Cistercians. He was canonized by Clement XI. in 1712. There are extant several of his letters, printed at Anvers in 1640, in 4to. Felibian, in 1672, published his *Life*, translated from the Italian of Agatio di Somma; but we cannot vouch for the fidelity of the translation.

PIX. See *Mint-Marks.*

PIZARRO, Francis, a celebrated Spanish general, the discoverer and conqueror of Peru, in conjunction with Diego Almagro, a Spanish navigator. They are both charged with horrid cruelties to the inhabitants; and they fell victims to their own ambition, jealousy, and avarice. Almagro revolting, was defeated and beheaded by Pizarro, who was assassinated by Almagro's friends in 1541. See Peru.

PLACE, Locus, in *Philosophy*, a mode of space, or that part of immoveable space which any body possesses. See Metaphysics, N° 185.

Place, in *Astronomy*. The place of the sun, a star, &c. denotes the sign and degree of the zodiac which the luminary is in; or the degree of the ecliptic, reckoning from the beginning of Aries, which the planet's or star's circle of longitude cuts: and therefore coincides with the longitude of the sun, planet, or star. As the sine of the sun's greatest declination 23° 30′: to the sine of any present declination given or observed, for instance, 23° 15′ : : so is the radius 10 : to the sine of its longitude 81° 52′; which, if the declination were north, would give 20° 52′ of Gemini; if south, 20° 52′ of Capricorn for the sun's place. See Declination, &c.

The place of the moon being that part of her orbit wherein she is found at any time, is of various kinds, by reason of the great inequalities of the lunar motions, which render a number of equations and reductions necessary before the just point be found. The moon's fictitious place is her place once equated; her place nearly true, is her place twice equated; and her true place thrice equated. See Astronomy, *passim.*

Place, in *War*, a general name for all kinds of fortresses where a party may defend themselves. Thus, 1. A strong or fortified place is one flanked, and covered with bastions. 2. A regular place, one whose angles, sides, bastions, and other parts, are equal; and this is usually denominated from the number of its angles, as a pentagon, hexagon, &c. 3. Irregular place is one whose sides and angles are unequal.—4. Place of arms is a strong city or town pitched upon for the chief magazine of an army; or, in a city or garrison, it is a large open spot of ground, usually near the centre of the place where the grand guard is commonly kept, and the garrison holds its rendezvous at reviews, and in cases of alarm to receive orders from the governor. 5. Places of arms of an attack, in a siege, is a spacious place covered from the enemy by a parapet or epaulement, where the soldiers are posted ready to sustain those at work in the trenches against the soldiers of the garrison. 6. Place of arms particular, in a garrison, a place near every bastion, where the soldiers sent from the grand place to the quarters assigned them relieve those that are either upon the guard or in sight. 7. Place of arms without, is a place allowed to the covert way for the planting of cannon, to oblige those who advance in their approaches to retire. 8. Place of arms in a camp, a large place at the head of the camp for the army to be ranged in and drawn up in battalia. There is also a place for each particular body, troop, or company, to assemble in.

Common-Place. See *Common-Place.*

PLACENTA, in *Anatomy* and *Midwifery*, a soft roundish mass, found in the womb of pregnant women; which, from its resemblance to the liver, was called by the ancients *hepar uterinum*, uterine liver.

PLACENTIA, called by the natives *Piacenza*, is a town of Italy, and capital of a duchy of the same name, with a bishop's see. It is seated about 100 paces from the river Po, in a very fertile pleasant plain watered by a great number of rivulets, and surrounded with hills, abounding in all sorts of fruits. In its territory there are salt-springs, from which they make a very white salt; and there are also mines of iron, woods, and warrens. It contains a great number of merchants, and is reckoned three miles in circumference. Its fortifications are inconsiderable, but the citadel is pretty strong. The streets are straight, and the principal street called *Stradone*, is 25 common paces broad, and 3000 feet long, in a direct line, with 600 stone posts for separating the foot from the carriage-way, and on both sides are 11 spacious convents. The other buildings of the city are not very remarkable, though it contains 45 churches, 28 convents, and two alms-houses. The cathedral is pretty much in the Gothic taste; but the church of the Augustines is reckoned the most beautiful, and esteemed worthy of its architect, the celebrataed Vignoli. The ducal palace, though large, makes no great appearance externally; but within there are some good apartments. In the area before the town-house stand two admirable brass statues of Alexander and Renatus IV. both of the house of Farnese, and dukes of Parma and Placentia. The bishop is suffragan to the archbishop of Milan. At this city begins the Via Æmilia, which extends as far as Rimini on the Adriatic. The number of the inhabitants is about 30,000, among whom there are 2000 ecclesiastics. This city has been taken several times in the wars of Italy. The king of Sardinia took possession of it in 1744, it being ceded to him by the queen of Hungary; but it was taken from him in 1746, after a bloody battle. The French got possession of it in 1796. It has a famous university, and the inhabitants are much esteemed for their politeness. The sovereignty of this duchy with that of Parma now belongs to Maria Louisa, late empress of France. Placentia is about 32 miles north-west of Parma and 83 east of Turin. E. Long. 10. 24. Lat. 45. 5.

PLAGIARY, in *Philology*, the purloining another man's works, and putting them off as our own. Among the Romans, *plagiarius* was properly a person who bought, sold, or retained a freeman for a slave; and was so called, because, by the Flavian law, such persons were condemned *ad plagas*, "to be whipped."

Thomasius has an express treatise *de plagio literario;* wherein he lays down the laws and measures of the right which authors have to one another's writings.—"Dictionary writers, at least such as middle with *arts and sciences* (as is pertinently observed by Mr Chalmers), seem exempted from the common laws of *meum* and *tuum:* they do not pretend to set up on their own bottom, nor to treat you at their own cost. Their works are supposed, in great measure, compositions of other peoples; and what they take from others, they do it avowedly, and in the open sun.—In effect, their quality gives them a title to every thing that may be for their purpose, wherever they find it; and if they rob, they do not do it any otherwise than as the bee does, for the public service. Their occupation is not pillaging, but collecting contributions; and, if you ask them their authority, they will produce you the practice of their predecessors of all ages and nations.

PLAGIUM, in *Law*. See KIDNAPPING.

PLAGUE, PESTILENCE, or *Pestilential Fever*, is a very acute, malignant, and contagious disease; being a putrid fever of the worst kind, and seldom failing to prove mortal. Though it is generally defined a malignant fever, Diemerbroeck thinks they ought to be distinguished, since the fever is not the essence of the disease, but merely a symptom or effect of it. See MEDICINE, N° 221.

The plague, as is generally agreed, is never bred or propagated in Britain, but always imported from abroad, especially from the Levant, Lesser Asia, Egypt, &c. where it is very common. Sydenham has remarked that it rarely infests this country oftener than once in 40 years, and happily we have been free of it for a much longer period.

Authors are not as yet agreed concerning the nature of this dreadful distemper. Some think that insects are the cause of it, in the same way that they are the cause of blights, being brought in swarms from other climates by the wind, when they are taken into the lungs in respiration; the consequence of which is, that they mix with the blood and juices, and attack and corrode the viscera. Mr Boyle, on the other hand, thinks it originates from the effluvia or exhalations breathed into the atmosphere from noxious minerals, to which may be added stagnant waters and putrid bodies of every kind.

Mr Gibbon thinks that the plague is derived from damp, hot, and stagnating air, and the putrefaction of animal substances, especially locusts. See *Gibbon's Roman History*, 4to edit. vol. iv. p. 327—332, where there is also a very particular account of the plague which depopulated the earth in the time of the emperor Justinian.

The Mahometans believe that the plague proceeds from certain spirits, or goblins, armed with bows and arrows, sent by God to punish men for their sins; and that when the wounds are given by spectres of a black colour, they certainly prove fatal, but not so when the arrows are shot by those that appear white. They therefore take no precaution to guard themselves against it. The wiser professors of this religion, however, at present act otherwise; for we find a receipt recommended by Sidy Mohammed Zerroke, one of the most celebrated Marabouts, prefaced with these remarkable words: "The lives of us all are in the hands of God, when it is we must die. However, it hath pleased him to save many persons from the plague, by taking every morning while the infection rages, one pill or two of the following composition; viz. of myrrh two parts, saffron one part, of aloes two parts, of syrup of myrtle berries, *q. s.*" But this remedy is confined to the more enlightened; for the bigotry of the lower sort is so extreme as to make them despise all precautions which people of other nations use. Of this extreme and foolish prejudice Dr Chandler gives an interesting account when speaking of the plague at Smyrna. This learned author is of opinion that the disease arises from animalcules, which he supposes to be invisible. See *Chandler's Travels in Asia Minor*, p. 279, &c.

It is a remarkable fact, that *plagues* are sometimes partial, and that they only attack particular animals, or a particular description of persons, avoiding others altogether, or attacking them but slightly. Thus Fernelius informs us of a plague, or murrain, in 1514, which invaded only cats. Dionysius Halicarnasseus mentions a plague which attacked none but maids; and that which raged in the time of Gentilis, killed scarcely any women, and very few but lusty men. Boterus mentions another plague, which assaulted none but the younger sort; and we have instances of the same kind of a later standing (A). Cardan speaks of a plague at Basil, with which the Switzers were infected, and the Italians, Germans, or French, exempted: and John Utenhovius takes notice of a dreadful one at Copenhagen, which, though it raged among the Danes, spared the Germans, Dutch, and English, who went with all freedom, and without the least danger, to the houses of the infected. During the plague which ravaged Syria in 1760, it was observed that people of the soundest constitutions were the most liable to it, and that the weak and delicate were either spared or easily cured. It was most fatal to the Moors; and, when it attacked them, it was generally incurable.

When the plague raged in Holland in 1636, a young girl was seized with it, had three carbuncles, and was removed to a garden, where her lover, who was betrothed to her, attended her as a nurse, and slept with her as his wife. He remained uninfected, and she recovered, and was married to him. The story is related by Vinc. Fabricius in the *Misc. Cur. Ann. II. Obs.* 188.

Many methods have been adopted in different countries to prevent the importation of this dreadful scourge of the human race, and to stop the progress of infection after it has been imported. In England, mayors, bailiffs, head officers of corporations, and justices of peace, have power to tax inhabitants, houses, and lands, &c. within their precincts, for the relief of persons infected with the plague; and justices of the county may tax persons within five miles round, on a parish's inability; the tax to be levied by distress and sale of goods, or in default thereof by imprisonment. Infected persons going abroad, after being commanded to keep house for avoiding farther infections, may be resisted by watchmen, &c. and punished as vagrants, if they have no sores upon them; and if they have infectious sores on them it is felony. Justices of the peace, &c. are to appoint searchers, examiners, and buriers of the dead, in places infected, and administer oaths to them for the performance of their duties, &c. *stat.* 1 *Jac. I. cap.* 31. See QUARANTINE.

The commission at Moscow having, in the year 1770, invented a fumigation powder, which, from several lesser experiments, had proved efficacious in preventing the infection of the plague; in order more fully to ascertain its virtue in that respect, it was determined,

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(A) See account of the *yellow fever* under the article PHILADELPHIA, where it appears that the disease was less fatal to some sorts of persons than to others.

termined, towards the end of the year, that ten malefactors under sentence of death should, without undergoing any other precautions than the fumigations, be confined three weeks in a lazaretto, be laid upon the beds, and dressed in the clothes, which had been used by persons sick, dying, and even dead, of the plague in the hospital. The experiment was accordingly tried, and none of the ten malefactors were then infected, or have been since ill. The fumigation powder is prepared as follows.

Powder of the first strength.] Take leaves of juniper, juniper-berries pounded, ears of wheat, guaiacum wood pounded, of each six pounds; common saltpetre pounded, eight pounds; sulphur pounded, six pounds; Smyrna tar, or myrrh, two pounds: mix all the above ingredients together, which will produce a pood of the powder of fumigation of the first strength. [*N. B.* A pood is 40 pounds Russian, which are equal to 35 pounds and a half or 36 pounds English avoirdupoise.]

Powder of the second strength.] Take southernwood cut into small pieces, four pounds; juniper-berries pounded, three pounds; common saltpetre pounded, four pounds; sulphur pounded, two pounds and a half; Smyrna tar, or myrrh, one pound and a half: mix the above together which will produce half a pood of the powder of fumigation of the second strength.

Odoriferous powder.] Take the root called *kalmus* cut into small pieces, three pounds; leaves of juniper cut into small pieces, four pounds; frankincense pounded grossly, one pound; storax pounded, and rose flowers, half a pound; yellow amber pounded, one pound; common saltpetre pounded, one pound and a half; sulphur, a quarter of a pound: mix all the above together, which will produce nine pounds and three quarters of the odoriferous powder.

Remark on the powder of fumigation.] If guaiacum cannot be had, the cones of pines or firs may be used in its stead; likewise common tar of pines and firs may be used instead of the Smyrna tar, or myrrh, and mugwort may supply the place of southernwood.

Thucydides, who was himself infected, lib. ii. gives us an account of a dreadful plague which happened at Athens, about the year before Christ 430, while the Peleponnesians under the command of Archidamus wasted all their territory abroad; but of these two enemies the plague was by far the most dreadful and severe.

The most dreadful plague that ever raged at Rome was in the reign of Titus, A. D. 80. The emperor left no remedy unattempted to abate the malignity of the distemper, acting during its continuance like a father to his people. The same fatal disease raged in all the provinces of the Roman empire in the reign of M. Aurelius, A. D. 167, and was followed by a dreadful famine, by earthquakes, inundations, and other calamities. The Romans believed that Æsculapius sometimes entered into a serpent, and cured the plague.

About the year 430 the plague visited Britain, just after the Picts and Scots had made a formidable invasion of the southern part of the island. The plague raged with uncommon fury, and swept away most of those whom the sword and famine had spared, so that the living were scarcely sufficient to bury the dead.

About the year 1348 the plague became almost general over Europe. A great many authors give an account of this plague, which is said to have appeared first in the kingdom of Kathay in the year 1346, and to have proceeded gradually westward to Constantinople and Egypt. From Constantinople it passed into Greece, Italy, France, and Africa, and by degrees along the coasts of the ocean into Britain and Ireland, and afterwards into Germany, Hungary, Poland, Denmark and the other northern kingdoms. According to Antoninus archbishop of Florence the distemper carried off 60,000 people in that city, among whom was the historian John Villani.

In the year 1656 the plague was brought from Sardinia to Naples, being introduced into the city by a transport with soldiers on board. It raged with excessive violence, carrying off in less than six months 400,000 of the inhabitants. The distemper was at first called by the physicians a malignant fever; but one of them affirming it to be pestilential, the viceroy, who was apprehensive lest such a report would occasion all communication with Naples to be broke off, was offended with this declaration, and ordered him to be imprisoned. As a favour, however, he allowed him to return and die in his own house. By this proceeding of the viceroy, the distemper being neglected, made a most rapid and furious progress, and filled the whole city with consternation. The streets were crowded with confused processions, which served to spread the infection through all the quarters. The terror of the people increased their superstition; and it being reported that a certain nun had prophesied that the pestilence would cease upon building a hermitage for her sister nuns upon the hill of St Martin's, the edifice was immediately begun with the most ardent zeal. Persons of the highest quality strove who should perform the meanest offices; some loading themselves with beams, and others carrying baskets full of lime and nails, while persons of all ranks stripped themselves of their most valuable effects, which they threw into empty hogsheads placed in the streets to receive the charitable contributions. Their violent agitation, however, and the increasing heats, diffused the malady through the whole city, and the streets and the stairs of the churches were filled with the dead; the number of whom, for some time of the month of July, amounted daily to 15,000.

The viceroy now used all possible precautions to abate the fury of the distemper, and to prevent its spreading to the provinces. The infection, however, desolated the whole kingdom, excepting the provinces of Otranto and the Farther Calabria, and the cities of Gaeta, Sorrento, Paolo, and Belvidere. The general calamity was increased in Naples by malecontents, who insinuated that the distemper had been designedly introduced by the Spaniards, and that there were people in disguise who went through the city sowing poisoned dust. This idle rumour enraged the populace, who began to insult the Spanish soldiers, and threaten a sedition; so that the viceroy, to pacify the mob, caused a criminal to be broke upon the wheel, under pretence that he was a disperser of the dust. A violent and plentiful rain falling about the middle of August, the distemper began to abate; and on the eighth of December the physicians made a solemn declaration that the city was entirely free from infection.

Of the dreadful plague which raged at London in the year 1665, the reader will find an account in the article LONDON, N° 21. In 1720 the city of Marseilles was visited with this destructive disease, brought in a ship from the Levant; and in seven months, during which time it continued, it carried off not less than 60,000 people. This desolation is not yet obliterated from the minds of the inhabitants; some survivors remained alive but a few years ago to transmit a traditional account of it to after ages. There are two fine pictures, painted by Puget, representing some of the horrid scenes of that time. "They are (says Lady Craven) only too well executed. I saw several dying figures taking leave of their friends, and looking their last anxious, kind, and wishful prayers on their sick infants, that made the tears flow down my cheeks. I was told the physicians and noblemen who were assisting the sick and dying, were all portraits: I can easily conceive it; for in some faces there is a look of reflection and concern which could only be drawn from the life." *Letters*, p. 34, 35. This fatal event has caused the laws of quarantine to be very strictly enforced in the lazaretto here, which is an extensive insulated building.

The ravages of this disease have been dreadful wherever it has made its appearance. On the first arrival of the Europeans at the island of Gran Canaria, it contained 14,000 fighting men, soon after which, two thirds of the whole inhabitants fell a sacrifice to the plague, which had doubtless been introduced by their new visitors. The destruction it has made in Turkey in Europe, and particularly in Constantinople, must be known to every reader; and its fatal effects have been particularly heightened there by that firm belief which prevails among the people of predestination, &c. as has been already mentioned. It is generally brought into European Turkey from Egypt; where it is very frequent, especially at *Grand CAIRO*. To give even a list of all the plagues which have desolated many flourishing countries, would extend this article beyond all bounds; and minutely to describe them all, would be impossible. For the plague at Smyrna, we refer to Chandler's Travels as above. Respecting that which raged in Syria in 1760, we refer to the Abbé Mariti's Travels through Cyprus, Syria, and Palestine, vol. i. p. 278—296. This plague was one of the most malignant and fatal that Syria ever experienced; for it scarcely made its appearance in any part of the body when it carried off the patient.

In addition to what the reader will find upon this subject in the article MEDICINE, and the observations which have now been offered, we beg leave to state the sentiments of Berthier on this subject, in his account of Bonaparte's expedition into Syria.

"At the time of our entry into Syria (says he), all the towns were infected by the plague; a malady which ignorance and barbarity render so fatal in the east. Those who are affected by it give themselves up for dead; they are immediately abandoned by every body, and are left to die, when they might have been saved by medicine and attention.

"Citizen Degenettes, principal physician to the army, displayed a courage and character which entitle him to the national gratitude. When our soldiers were attacked by the least fever, it was supposed that they had caught the plague, and these maladies were confounded. The fever hospitals were abandoned by the officers of health and their attendants. Citizen Degenettes repaired in person to the hospitals, visited all the patients, felt the glandular swellings, dressed them, declared and maintained that the distemper was not the plague, but a malignant fever with glandular swellings, which might easily be cured by attention, and keeping the patient's mind easy."

The views of Degenettes in making this distinction were worthy of the highest commendation; but Dr Moseley maintains that this fever was actually the plague. The physician, however, carried his courage so far, as to make two incisions, and to inoculate the suppurated matter from one of these buboes above his breast, and under his armpits, but was not affected with the malady. He thus eased the minds of the soldiers, the first step to a cure; and, by his assiduity and constant attendance in the hospitals, a number of men attacked with the plague were cured. His example was followed by other officers of health. "There are, says Dr Moseley, annual or seasonal disorders, more or less severe, in all countries; but the plague, and other great depopulating epidemics, do not always obey the seasons of the year. Like comets, their course is eccentric. They have their revolutions; but from whence they come, or whither they go after they have made their revolution, no mortal can tell.

"Diseases originating in the atmosphere seize some, and pass by others; and act exclusively on bodies graduated to received their impressions; otherwise whole nations would be destroyed. In some constitutions of the body the access is easy, in some difficult, and in others impossible.

"The air of confined places may be so vitiated as to be unfit for the purposes of the healthy existence of any person. Hence gaol, hospital, and ship fevers. But, as these distempers are the offspring of a local cause, that local cause, and not the distempered people, communicate the disease.

"The infection, were it not in the atmosphere, would be confined within very narrow limits; have a determinate sphere of action; and none but physicians and attendants on the sick would suffer; and these must suffer; and the cause and the effects would be palpable to our senses. Upon this ground, the precaution of quarantine would be rational. But who then would visit and attend the sick, or could live in hospitals, prisons, and lazarettoes?"

The author is convinced from these reasonings, that the bubo and carbuncle, of which we hear so much in Turkey, and read so much in our own history of plagues, arise from heating food and improper treatment; that they contain no infection; and consequently that they are not the natural deposit of the morbific virus separated from the contagion.

Speaking of the plague, Mr Brown says, "the first symptoms are said to be thirst; 2. Cephalagia; 3. A stiff and uneasy sensation, with redness and tumour about the eyes; 4. Watering of the eyes; 5. White pustules on the tongue. Not uncommonly, all these have successively shown themselves, yet the patient has recovered; in which case, where suppuration has had place, the skin always remains discoloured, commonly of a purple hue. Many who have been bled in an early stage of the disorder, have recovered without any fatal symptoms; but whether from that or any other cause, does not appear certain."

Oil rubbed into the skin acts as a preventive, as well as a cure of the plague. When the operation is performed to prevent infection, it is successfully performed with that view at Smyrna, as often as the plague make its appearance in the city. As it is not done for the purpose of promoting perspiration, it is not requisite that it should be performed with the same speed as when for curing the disorder; nor is it necessary to abstain from flesh, and to use soups; but it will be proper to use only fowls or veal for some days, without any seasoning. It will in fine be necessary to guard against indigestible food, and such liquors as might put in motion or inflame the mass of the blood.

This interesting discovery merits the attention of all medical men; for if olive oil has been found efficacious in curing or preserving against one species of infection, it is not absurd to suppose that the same or other kinds of oil might be productive of much benefit in other malignant infectious diseases. We hope soon to hear of some trial being made with it in this country. Would it be of any service in the yellow fever, so prevalent in the western world?

PLAIN, or PLANE, in general, an appellation given to whatever is smooth and even, or simple, obvious, and easy to be understood; and, consequently, stands opposed to rough, enriched, or laboured.

A plain figure, in geometry, is an uniform surface; from every point of whose perimeter right lines may be drawn to every other point in the same.

A plain angle is one contained under two lines, or surfaces, in contradistinction to a solid angle. See ANGLE under GEOMETRY.

The doctrine of plain triangles, as those included under three right lines, is termed *plain trigonometry*. See the article TRIGONOMETRY.

PLAIN-Chart. See the article CHART.

PLAIN-Sailing. See NAVIGATION.

PLAISE, the English name of a species of pleuronectes. See PLEURONECTES, ICHTHYOLOGY *Index*.

PLAN, in general, denotes the representation of something drawn on a plane; such are maps, charts, ichnographies, &c. See MAP, CHART, &c.

The term *plan*, however, is particularly used for a draught of a building, such as it appears, or is intended to appear, on the ground, showing the extent, division, and distribution of its area or ground-plot into apartments, rooms, passages, &c.

A geometrical plan is that wherein the solid and vacant parts are represented in their natural proportions.

The raised plan of a building is the same with what is otherwise called an *elevation* or *orthography*. See ORTHOGRAPHY.

A perspective plan is that exhibited by degradations or diminutions, according to the rules of perspective. See PERSPECTIVE.

To render plans intelligible, it is usual to distinguish the massives with a black wash; the projectures of the ground are drawn in full lines, and those supposed over them in dotted lines. The augmentations or alterations to be made are distinguished by a colour different from what is already built; and the tints of each plan made lighter as the stories are raised.

In large buildings it is usual to have three several plans for the three first stories.

PLANCUS, FRANCIS, doctor of physic, was born at Amiens in 1696, and died on the 19th of September 1765, aged 69 years. He is the author of some works which have had considerable reputation. 1. A complete System of Surgery, in 2 vols in 12mo; a treatise much recommended by surgeons to their pupils. 2. A choice Library of Medicine, taken from periodical publications, both French and others: this curious collection, continued and completed by M. Goulin, makes 9 vols in 4to, or 18 vols in 12mo. 3. A Translation of Vander Wiel's Observations on Medicine and Surgery, 1758, 2 vols in 12mo. Plancus was also the editor of various editions of works on medicine and surgery, which he enriched with notes.

PLANE, in *Geometry*, denotes a plain surface, or one that lies evenly between its bounding lines: and as a right line is the shortest extension from one point to another, so a plane surface is the shortest extension from one line to another.

In astronomy, conics, &c. the term *plane* is frequently used for an imaginary surface, supposed to cut and pass through solid bodies; and on this foundation is the whole doctrine of conic sections built. See ASTRONOMY, CONIC *Sections*, &c.

In mechanics, planes are either horizontal, that is, parallel to the horizon, or inclined thereto. See MECHANICS.

The determining how far any given plane deviates from an horizontal line, makes the whole business of levelling. See the article LEVELLING.

In optics, the planes of reflection and refraction are those drawn through the incident and reflected or refracted rays. See OPTICS.

In perspective we meet with the perspective plane, which is supposed to be pellucid, and perpendicular to the horizon; the horizontal plane, supposed to pass through the spectator's eye, parallel to the horizon; the geometrical plane, likewise parallel to the horizon, wherein the object to be represented is supposed to be placed, &c. See PERSPECTIVE.

The plane of projection in the stereographic projection of the sphere, is that on which the projection is made, corresponding to the perspective plane. See PROJECTION.

PLANE, in joinery, an edged tool or instrument for paring and shaving of wood smooth. It consists of a piece of wood very smooth at bottom, as a stock or shaft; in the midst of which is an aperture, through which a steel edge, or chissel, placed obliquely, passes; which, being very sharp, takes off the inequalities of the wood along which it slides.

PLANE-Tree, in *Botany*. See PLATANUS.

PLANET, a celestial body, revolving round the sun as a centre, and continually changing its position with respect to the fixed stars; whence the name *planet*, which is a Greek word, signifying "wanderer."

The planets are usually distinguished into primary and secondary. The primary ones, called by way of eminence *planets*, are those which revolve round the sun as a centre; and the secondary planets, more usually called *satellites* or *moons*, are those which revolve round a primary planet as a centre, and constantly attend it in its revolution round the sun.

The primary planets are again distinguished into superior and inferior. The superior planets are those farther from the sun than our earth; as Mars, Jupiter, Saturn, and the Georgium Sidus; and the inferior planets are those nearer the sun than our earth, as Venus and Mercury. For an account of the planets lately discovered, see VESTA.

That the planets are opaque bodies, like our earth, is thought probable for the following reasons. 1. Since in Venus, Mercury, and Mars, only that part of the disk illuminated by the sun is found to shine; and again, Venus and Mercury, when between the earth and the sun, appear like dark spots or maculæ on the sun's disk; it is evident, that Mars, Venus, and Mercury, are opaque bodies, illuminated with the borrowed light of the sun. And the same appears of Jupiter, from its being void of light in that part to which the shadow of the satellites reaches, as well as in that part turned from the sun; and that his satellites are opaque, and reflect the sun's light, is abundantly shown. Again, since Saturn, with his ring and satellites, only yield a faint light, fainter considerably than that of the fixed stars, though these be vastly more remote, and than that of the rest of the planets; it is past doubt that he too with his attendants are opaque bodies. 2. Since the sun's light is not transmitted through Mercury and Venus, when placed against him, it is plain they are dense opaque bodies; which is likewise evident of Jupiter, from his hiding the satellites in his shadow; and therefore, by analogy, the same may be concluded of Saturn. 3. From the variable spots of Venus, Mars, and Jupiter, it is evident these planets have a changeable atmosphere; which changeable atmosphere may, by a like argument, be inferred of the satellites of Jupiter; and therefore, by similitude, the same may be concluded of the other planets. 4. In like manner, from the mountains observed in Venus, the same may be supposed in the other planets. 5. Since, then, Saturn, Jupiter, and the satellites of both, Mars, Venus, and Mercury, are opaque bodies shining with the sun's borrowed light, are furnished with mountains, and encompassed with a changeable atmosphere; they have, it is concluded, waters, seas, &c. as well as dry land, and are bodies like the moon, and therefore like the earth. And hence it seems also highly probable, that the other planets have their animal inhabitants as well as our earth.

PLANETARIUM, an astronomical machine, so called from its representing the motions, orbits, &c. of the planets, agreeable to the Copernican system. See ASTRONOMY.

PLANETARY, something that relates to the planets. Hence we say, planetary worlds, planetary inhabitants, &c. See PLANET.

PLANETARY System, is the system or assemblage of the planets, primary and secondary, moving in their respective orbits, round their common centre the sun. See ASTRONOMY.

PLANETARY Days.—Among the ancients, the week was shared among the seven planets, each planet having its day. This we learn from Dion Cassius and Plutarch, *Sympos*. l. 4. q. 7. Herodotus adds, that it was the Egyptians who first discovered what god, that is, what planet, presides over each day; for that among this people the planets were directors. And hence it is, that in most European languages the days of the week are still denominated from the planets; Sunday, Monday, &c. See WEEK.

PLANETARY Years, the periods of time in which the several planets make their revolutions round the sun or earth.—As from the proper revolution of the sun, the solar year takes its original; so from the proper revolutions of the rest of the planets about the earth, so many sorts of years do arise, viz. the Saturnian year, which is defined by 29 Egyptian years, 174 hours, 58 minutes, equivalent in a round number to 30 solar years. The Jovial year, containing 317 days, 14 hours, 59 minutes. —The Martial year, containing 321 days, 23 hours, 31 minutes. For Venus and Mercury, as their years, when judged of with regard to the earth, are almost equal to the solar year; they are more usually estimated from the sun, the true centre of their motions: in which case, the former is equal to 224 days, 16 hours, 40 minutes; the latter to 87 days, 23 hours, 14 minutes.

PLANIMETRY, that part of geometry which considers lines and plain figures, without considering their height or depth. See GEOMETRY.

PLANISPHERE, signifies a projection of the sphere, and its various circles, on a plane; in which sense, maps, whereon are exhibited the meridians and other circles of the sphere, are planispheres. See MAP.

PLANT is defined to be an organical body, destitute of sense and spontaneous motion, adhering to another body in such a manner as to draw from it its nourishment, and having a power of propagating itself by seeds.

The vegetation and economy of plants is one of those subjects in which our knowledge is extremely circumscribed. A total inattention to the structure and economy of plants is the chief reason of the small progress that has been made in the principles of vegetation, and of the instability and fluctuation of our theories concerning it; for which reason we shall give a short description of the structure of plants, beginning with the seed, and tracing its progress and evolution to a state of maturity.

1. *Of Seeds.*] The seeds of plants are of various figures and sizes. Most of them are divided into two lobes; though some, as those of the cress-kind, have six; and others, as the grains of corn, are not divided, but entire.

But as the essential properties of all seeds are the same, when considered with regard to the principles of vegetation, our particular descriptions shall be limited to one seed, viz. the great garden-bean. Neither is the choice of this seed altogether arbitrary; for, after it begins to vegetate, its parts are more conspicuous than many others, and consequently better calculated for investigation.

This seed is covered with two coats or membranes. The outer coat is extremely thin, and full of pores; but may be easily separated from the inner one (which is much thicker), after the bean has been boiled, or lain a few days in the soil. At the thick end of the bean there is a small hole visible to the naked eye, immediately over the radicle or future root, that it may have a free passage into the soil (fig. 1. A). When these coats are taken off, the body of the seed appears, which is divid-

Plate CCCCXL

ed into two smooth portions or lobes. The smoothness of the lobes is owing to a thin film or cuticle with which they are covered.

At the basis of the bean is placed the radicle or future root (fig. 3. A). The trunk of the radicle, just as it enters into the body of the seed, divides into two capital branches, one of which is inserted into each lobe, and sends off smaller ones in all directions through the whole substance of the lobes (fig. 4. AA). These ramifications become so extremely minute towards the edges of the lobes, that they require the finest glasses to render them visible. To these ramifications Grew and Malpighi have given the name of *seminal root;* because, by means of it, the radicle and plume, before they are expanded, derive their principal nourishment.

The plume, bud, or germ (fig. 3.), is inclosed in two small corresponding cavities in each lobe. Its colour and consistence is much the same with those of the radicle, of which it is only a continuation, but having a quite contrary direction; for the radicle descends into the earth, and divides into a great number of smaller branches or filaments; but the plume ascends into the open air, and unfolds itself into all the beautiful variety of stem, branches, leaves, flower, fruit, &c. The plume in corn shoots from the smaller end of the grain, and amongst maltsters goes by the name of *acrospire.*

The next thing to be taken notice of is the substance or parenchymatous part of the lobes. This is not a mere concreted juice, but is curiously organized, and consists of a vast number of small bladders resembling those in the pith of trees (fig. 5.)

Besides the coats, cuticle, and parenchymatous parts, there is a substance perfectly distinct from these, distributed in different proportions through the radicle, plume, and lobes. This inner substance appears very plainly in a transverse section of the radicle or plume. Towards the extremity of the radicle it is one entire trunk; but higher up it divides into three branches; the middle one runs directly up to the plume, and the other two pass into the lobes on each side, and spread out into a great variety of small branches through the whole body of the lobes (fig. 4.). This substance is very properly termed the *seminal root:* for when the seed is sown, the moisture is first absorbed by the outer coats, which are everywhere furnished with sap and air-vessels; from these it is conveyed to the cuticle; from the cuticle it proceeds to the pulpy part of the lobes; when it has got thus far, it is taken up by the mouths of the small branches of the seminal root, and passes from one branch into another, till it is all collected into the main trunk, which communicates both with the plume and radicle, the two principal involved organs of the future plant. After this the sap or vegetable food runs in two opposite directions: part of it ascends into the plume, and promotes the growth and expansion of that organ; and part of it descends into the radicle, for nourishing and evolving the root and its various filaments. Thus the plume and radicle continue their progress in opposite directions till the plant arrives at maturity.

It is here worth remarking, that every plant is really possessed of two roots, both of which are contained in the seed. The plume and radicle, when the seed is first deposited in the earth, derive their nourishment from the seminal root; but afterwards, when the radicle begins to shoot out its filaments, and to absorb some moisture, not, however, in a sufficient quantity to supply the exigencies of the plume, the two lobes, or main body of the seed, rise along with the plume, assume the appearance of two leaves, resembling the lobes of the seed in size and shape, but having no resemblance to those of the plume, for which reason they have got the name of *dissimilar leaves.*

These dissimilar leaves defend the young plume from the injuries of the weather, and at the same time, by absorbing dew, air, &c. assist the tender radicle in nourishing the plume, with which they have still a connection by means of the seminal root above described. But when the radicle or second root has descended deep enough into the earth, and has acquired a sufficient number of filaments or branches for absorbing as much aliment as is proper for the growth of the plume; then the seminal or dissimilar leaves, their utility being entirely superseded, begin to decay and fall off.

Plate CCCCXX. fig. 1. Fig. 1. A, the foramen or hole in the bean through which the radicle shoots into the soil.

Fig. 2. Fig. 2. A transverse section of the bean; the dots being the branches of the seminal root.

Fig. 3. Fig. 3. A, the radicle. B, the plume or bud.

Fig. 4. Fig. 4. A view of the seminal root branched out upon the lobes.

Fig. 5. Fig. 5. A longitudinal section of one of the lobes of the bean a little magnified, to show the small bladders of which the pulpy or parenchymatous part is composed.

Fig. 6. 7. Figs. 6. 7. A, a transverse section of the radicle. B, a transverse section of the plume, showing the organs or vessels of the seminal root.

Fig. 8. Fig. 8. The appearance of the radicle, plume, and seminal root, when a little further advanced in growth.

Having thus briefly described the seed, and traced its evolution into three principal organic parts, viz. the plume, radicle, and seminal leaves, we shall next take an anatomical view of the root, trunk, leaves, &c.

2. *Of the root.*] In examining the root of plants, the first thing that presents itself is the skin, which is of various colours in different plants. Every root, after it has arrived at a certain age, has a double skin. The first is coeval with the other parts, and exists in the seed: but afterwards there is a ring sent off from the bark, and forms a second skin; *e. g.* in the root of the dandelion, towards the end of May, the original or outer skin appears shrivelled, and is easily separated from the new one, which is fresher, and adheres more firmly to the bark. Perennial plants are supplied in this manner with a new skin every year; the outer one always falls off in the autumn and winter, and a new one is formed from the bark in the succeeding spring. The skin has numerous cells or vessels, and is a continuation of the parenchymatous part of the radicle. However, it does not consist solely of parenchyma; for the microscope shows that there are many tubular ligneous vessels interspersed through it.

When the skin is removed, the true cortical substance or bark appears, which is also a continuation of the parenchymatous part of the radicle, but greatly augmented. The bark is of very different sizes. In most trees it is exceeding thin in proportion to the wood and pith. On the other hand, in carrots, it is almost one-half of the semidiameter of the root; and, in dandelion, it is nearly twice as thick as the woody part.

The bark is composed of two substances; the parenchyma or pulp, which is the principal part, and a few woody fibres. The parenchyma is exceedingly porous, and has a great resemblance to a sponge; for it shrivels considerably when dried, and dilates to its former dimensions when infused in water. These pores or vessels are not pervious, so as to communicate with each other; but consist of distinct little cells or bladders, scarcely visible without the assistance of the microscope. In all roots, these cells are constantly filled with a thin watery liquor. They are generally of a spherical figure; though in some roots, as the bugloss and dandelion, they are oblong. In many roots, as the horse-radish, peony, asparagus, potato, &c. the parenchyma is of one uniform structure. But in others it is more diversified, and puts on the shape of rays, running from the centre towards the circumference of the bark. These rays sometimes run quite through the bark, as in lovage; and sometimes advance towards the middle of it, as in melilot and most of the leguminous and umbelliferous plants. These rays generally stand at an equal distance from each other in the same plant; but the distance varies greatly in different plants. Neither are they of equal sizes: in carrot they are exceedingly small, and scarcely discernible; in melilot and chervil, they are thicker. They are likewise more numerous in some plants than in others. Sometimes they are of the same thickness from one edge of the bark to the other; and some grow wider as they approach to the skin. The vessels with which these rays are amply furnished, are supposed to be air-vessels, because they are always found to be dry, and not so transparent as the vessels which evidently contain the sap.

In all roots there are ligneous vessels dispersed in different proportions through the parenchyma of the bark. These ligneous vessels run longitudinally through the bark in the form of small threads, which are tubular, as is evident from the rising of the sap in them when a root is cut transversely. These ligneous sap-vessels do not run in direct lines through the bark, but at small distances incline towards one another, in such a manner that they appear to the naked eye to be inosculated; but the microscope discovers them to be only contiguous, and braced together by the parenchyma. These braces or coarctations are very various both in size and number in different roots; but in all plants they are most numerous towards the inner edge of the bark. Neither are these vessels single tubes; but, like the nerves in animals, are bundles of 20 or 30 small contiguous cylindrical tubes, which uniformly run from the extremity of the root, without sending off any branches or suffering any change in their size or shape.

In some roots, as parsnep, especially in the ring next the inner extremity of the bark, these vessels contain a kind of lymph, which is sweeter than the sap contained in the bladders of the parenchyma. From this circumstance they have got the name of *lymph ducts*.

These lymph-ducts sometimes yield a mucilaginous lymph, as in the comfrey; and sometimes a white milky glutinous lymph, as in the angelica, sonchus, burdock, scorzonera, dandelion, &c. The lymph-ducts are supposed to be the vessels from which the gums and balsams are secerned. The lymph of fennel, when exposed to the air, becomes a clear transparent balsam; and that of the scorzonera, dandelion, &c. condenses into a gum.

The situation of the vessels is various. In some plants they stand in a ring or circle at the inner edge of the bark, as in asparagus; in others, they appear in lines or rays, as in borage; in the parsnep, and several other plants, they are most conspicuous towards the outer edge of the bark; and in the dandelion, they are disposed in the form of concentric circles.

The wood of roots is that part which appears after the bark is taken off, and is firmer and less porous than the bark or pith. It consists of two distinct substances, viz. the pulpy or parenchymatous, and the ligneous. The wood is connected to the bark by large portions of the bark inserted into it. These insertions are mostly in the form of rays, tending to the centre of the pith, which are easily discernible by the eye in a transverse section of most roots. These insertions, like the bark, consist of many vessels, mostly of a round or oval figure.

The ligneous vessels are generally disposed in collateral rows running longitudinally through the root. Some of these contain air, and others sap. The *air-vessels* are so called, because they contain no liquor. These air-vessels are distinguished by being whiter than the others.

The pith is the centrical part of the root. Some roots have no pith, as the stramonium, nicotiana, &c.; others have little or none at the extremities of the roots, but have a considerable quantity of it near the top. The pith, like every other part of a plant, is derived from the seed; but in some it is more immediately derived from the bark: for the insertions of the bark running in betwixt the rays of the wood, meet in the centre, and constitute the pith. It is owing to this circumstance, that, among roots which have no pith in their lower parts, they are amply provided with it towards the top, as in columbine, lovage, &c.

The bladders of the pith are of very different sizes, and generally of a circular figure. Their position is more uniform than in the bark. Their sides are not mere films, but a composition of small fibres or threads; which gives the pith, when viewed with a microscope, the appearance of a piece of fine gauze or net-work.

We shall conclude the description of roots with observing, that their whole substance is nothing but a congeries of tubes and fibres, adapted by nature for the absorption of nourishment, and of course the extension and augmentation of their parts.

Plate CCCCXI fig. 9.

Fig. 9. A transverse section of the root of wormwood as it appears to the naked eye.

Fig. 10.

Fig. 10. A section of fig. 9. magnified. AA, the skin, with its vessels. BBBB, the bark. The round holes CCC, &c. are the lymph-ducts of the bark: All the other holes are little cells and sap-vessels. DDD, parenchymatous insertions from the bark, with the cells, &c. EEEE, the rays of the wood, in which the holes are the air-vessels. *N. B.* This root has no pith.

3. *Of the Trunk, Stalk*, or *Stem.*] In describing the trunks of plants, it is necessary to premise, that whatever is said with regard them applies equally to the branches.

The trunk, like the root, consists of three parts, viz. the bark, wood, and pith. These parts, though substantially the same in the trunk as in the root, are in many cases very different in their texture and appearance. The

ANATOMY of PLANTS. PLATE CCCCXX.

Fig. 1.
Garden Bean.

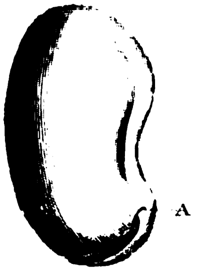


Fig. 2.

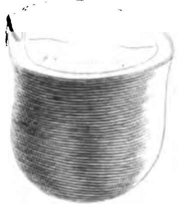


Fig. 3.

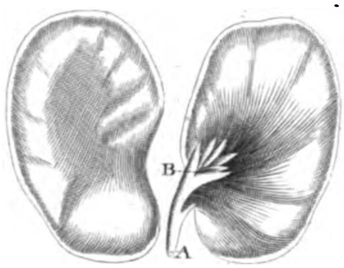


Fig. 4.

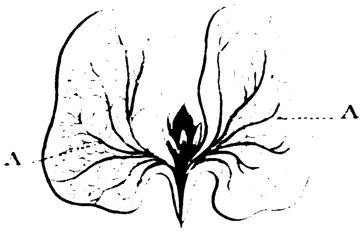


Fig. 5.
Slice of a Bean.

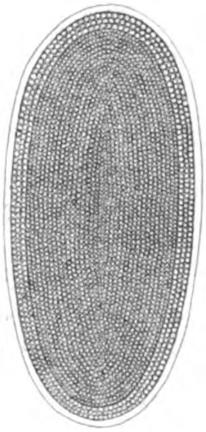


Fig. 6.
Radicle.

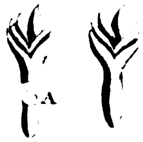


Fig. 7.
Plumula.

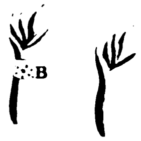


Fig. 9.
Wormwood Root, cut transversely.

Fig. 10.
Section of Fig. 9. Magnified.

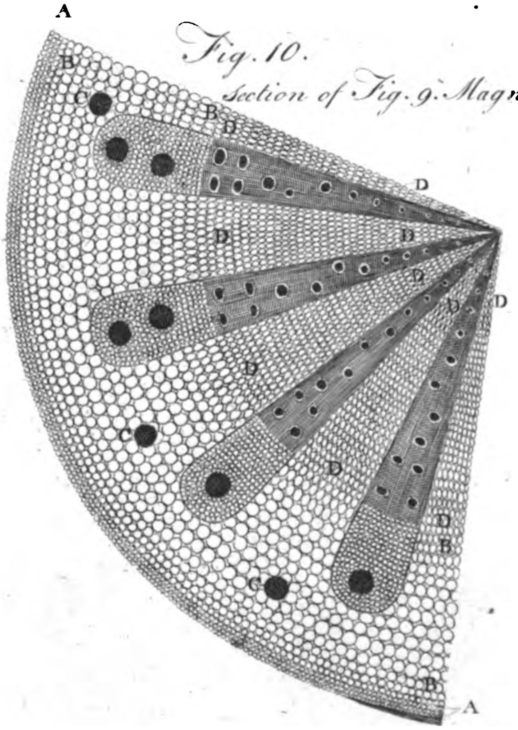
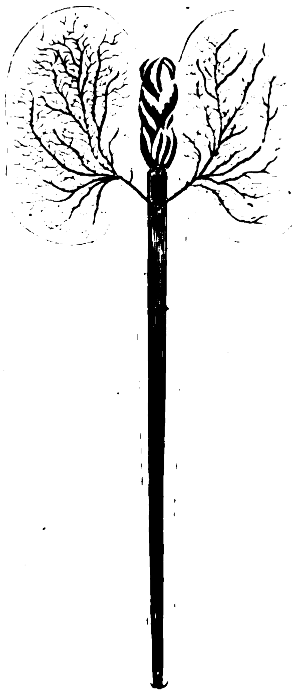


Fig. 8.



W. Archibald Sculp

ANATOMY of PLANTS. PLATE CCCCXXI.

Fig. 12.
Transverse Section of the Ash Branch Magnified.

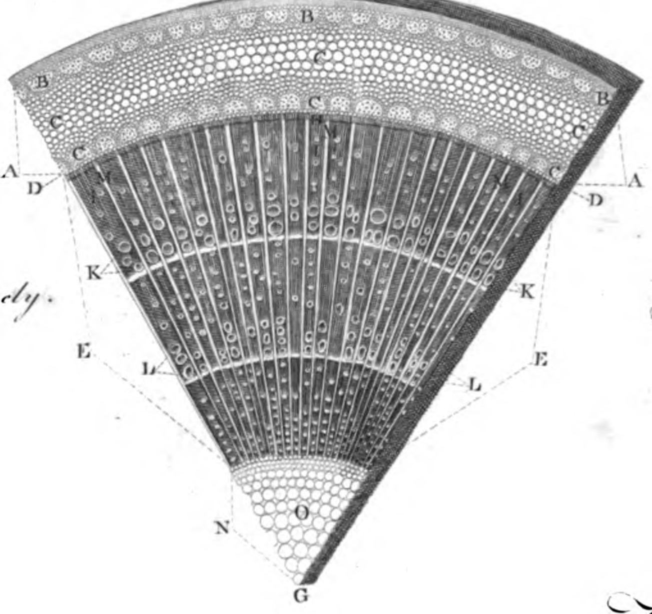


Fig. 11.
Ash Branch cut transversely.

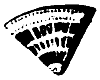


Fig. 14.

Fig. 15.

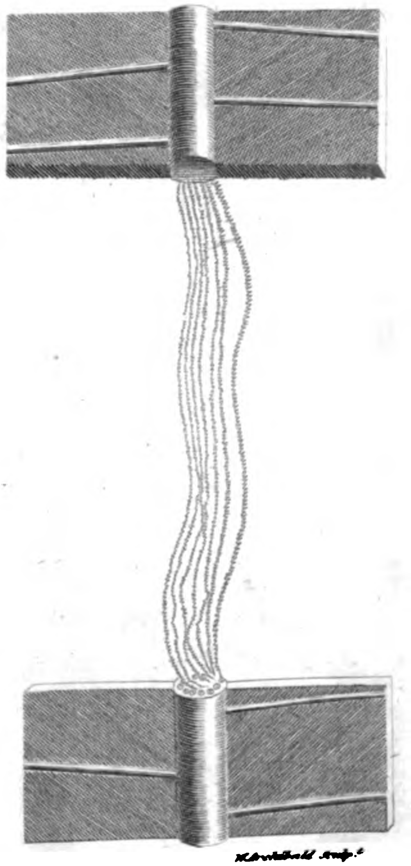
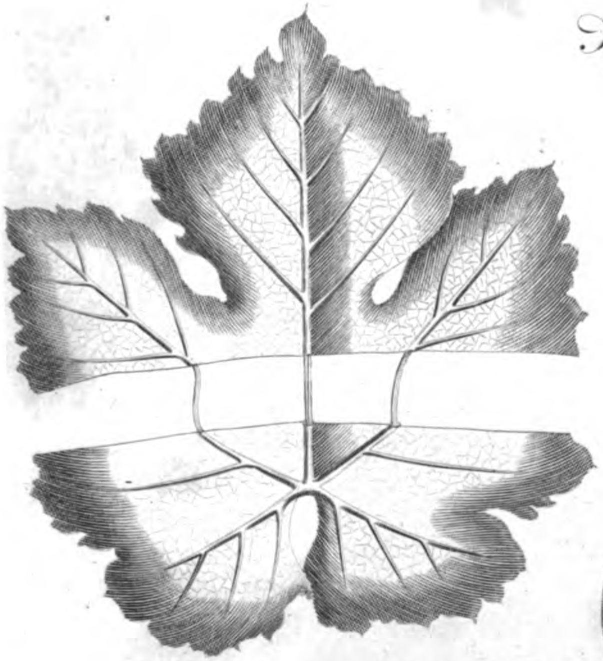
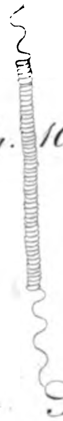


Fig. 13.
Vine Leaf.





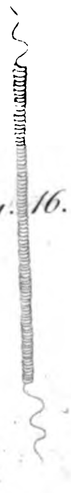
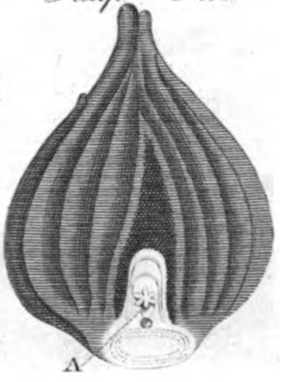


Fig. 16. Fig. 16.

Fig. 17.
Tulip Root.



W. Archibald Sculp.t

Fig. 18.

PEAR CUT TRANSVERSELY.

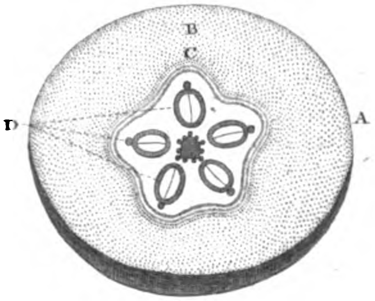


Fig. 19.

PIECE CUT OFF *Fig. 18.*

Fig. 20.

Fig. 19. MAGNIFIED.

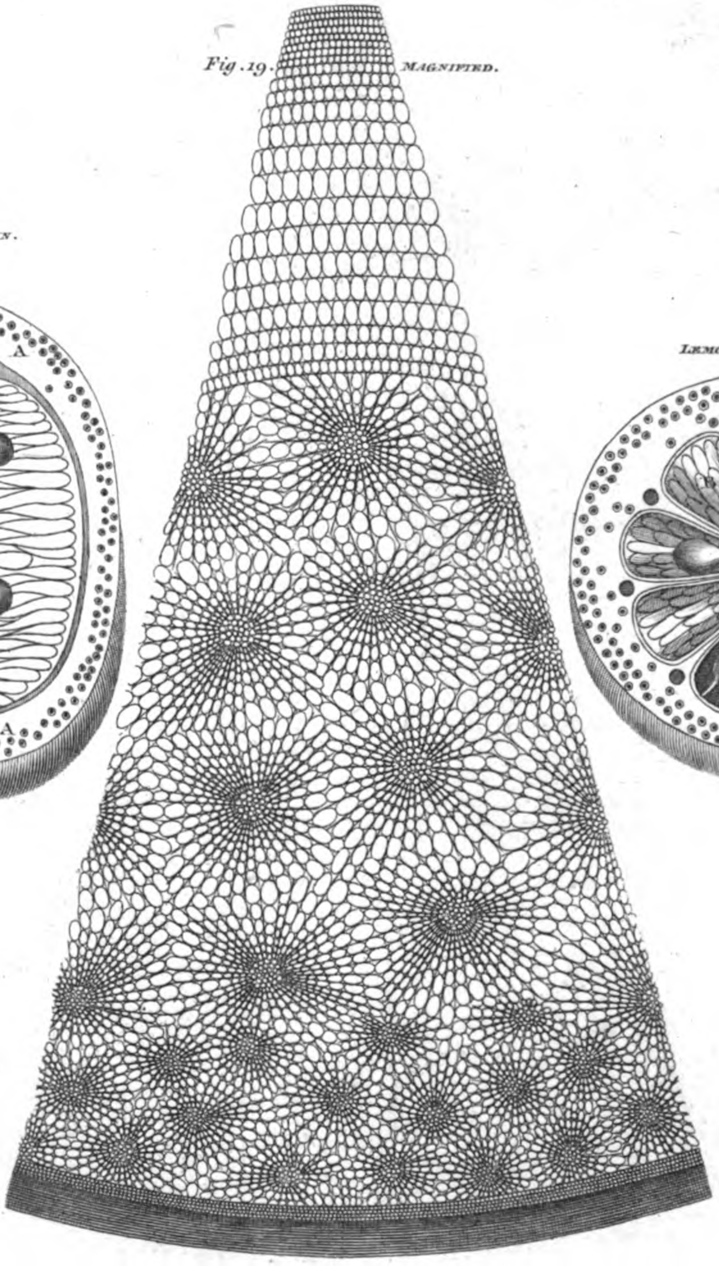


Fig. 21.

PEAR CUT LONGITUDINALLY.

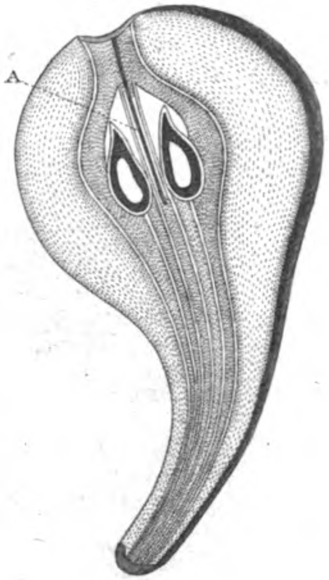


Fig. 22.

LEMON CUT DOWN.

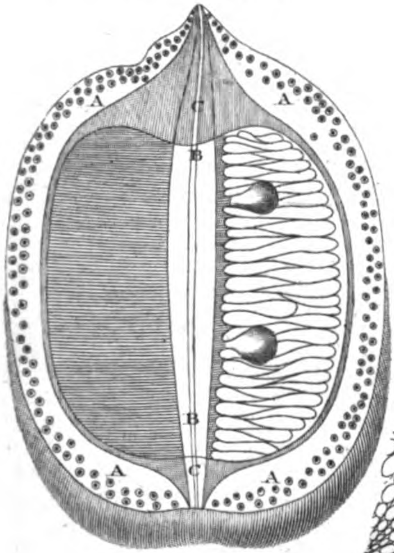
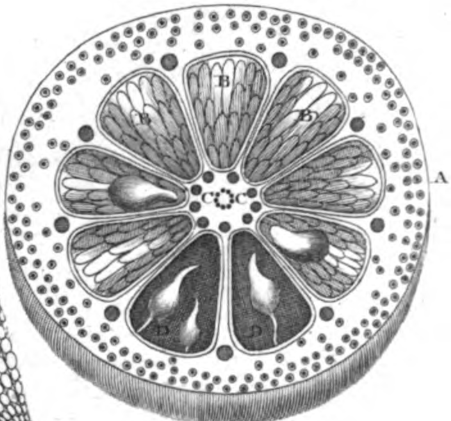


Fig. 23.

LEMON CUT TRANSVERSELY.



W. Archibald sculp.^t

The skin of the bark is composed of very minute bladders, interspersed with longitudinal woody fibres, as in the nettle, thistle, and most herbs. The outside of the skin is visibly porous in some plants, particularly the cane.

The principal body of the bark is composed of pulp or parenchyma, and innumerable vessels much larger than those of the skin. The texture of the pulpy part, though the same substance with the parenchyma in roots, yet seldom appears in the form of rays running towards the pith; and when these rays do appear, they do not extend above half-way to the circumference. The vessels of the bark are very differently situated, and destined for various purposes in different plants. For example, in the bark of the pine, the innermost are lymph-ducts, and exceedingly small; the outermost are gum or resiniferous vessels, destined for the secretion of turpentine; and are so large as to be distinctly visible to the naked eye.

The wood lies between the bark and pith, and consists of two parts, viz. a parenchymatous and a ligneous. In all trees, the parenchymatous part of the wood, though much diversified as to size and consistence, is uniformly disposed in diametrical rays, or insertions running betwixt similar rays of the ligneous part.

The true wood is nothing but a congeries of old dried lymph-ducts. Between the bark and the wood a new ring of these ducts is formed every year, which gradually loses its softness as the cold season approaches, and towards the middle of winter is condensed into a solid ring of wood. These annual rings, which are distinctly visible in most trees when cut through, serve as natural marks to distinguish their age (fig. 11, 12.). The rings of one year are sometimes larger, sometimes less, than those of another, probably owing to the favourableness or unfavourableness of the season.

The pith, though of a different texture, is exactly of the same substance with the parenchyma of the bark, and the insertions of the wood. The quantity of pith is various in different plants. Instead of being increased every year like the wood, it is annually diminished, its vessels drying up, and assuming the appearance and structure of wood; insomuch that in old trees there is scarce such a thing as pith to be discerned.

A ring of sap-vessels is usually placed at the outer edge of the pith next the wood. In the pine, fig, and walnut, they are very large. The parenchyma of the pith is composed of small cells or bladders, of the same kind with those of the bark, only of a larger size. The general figure of these bladders is circular; though in some plants, as the thistle and borage, they are angular. Though the pith is originally one connected chain of bladders, yet as the plant grows old they shrivel, and open in different directions. In the walnut, after a certain age, it appears in the form of a regular transverse hollow division. In some plants it is altogether wanting; in others, as the sonchus, nettle, &c. there is only a transverse partition of it at every joint. Many other varieties might be mentioned; but these must be left to the observation of the reader.

Plate CCCCXXI. fig. 11. Fig. 11. A transverse section of a branch of ash, as it appears to the eye.

Fig. 12. Fig. 12. The same section magnified. AA, the bark. BBB, an arched ring of sap-vessels next the skin. CCC, the parenchyma of the bark with its cells, and another arched ring of sap-vessels. DD, a circular line of lymph-ducts immediately below the above arched ring. EE, the wood. F, the first year's growth. G, the second. H, the third year's growth. III, the true wood. KK, the great air-vessels. LL, the lesser ones. MMM, the parenchymatous insertions of the bark represented by the white rays. NO, the pith, with its bladders or cells.

4. *Of the Leaves.*] The leaves of plants consist of the same substance with that of the trunk. They are full of nerves or woody portions, running in all directions, and branching out into innumerable small threads, interwoven with the parenchyma like fine lace or gauze.

The skin of the leaf, like that of an animal, is full of pores, which both serve for perspiration and for the absorption of dews, air, &c. These pores or orifices differ both in shape and magnitude in different plants, which is the cause of that variety of texture or grain peculiar to every plant.

The pulpy or parenchymatous part consists of very minute fibres, wound up into small cells or bladders. These cells are of various sizes in the same leaf.

All leaves, of whatever figure, have a marginal fibre, by which all the rest are bounded. The particular shape of this fibre determines the figure of the leaf.

The vessels of leaves have the appearance of inosculating; but, when examined by the microscope, they are found only to be interwoven or laid along each other.

What are called *air-vessels*, or those which carry no sap, are visible even to the naked eye in some leaves. When a leaf is slowly broken, they appear like small woolly fibres, connected to both ends of the broken piece.

Plate CCCCXXI. fig. 13. Fig. 13. The appearance of the air-vessels to the eye, in a vine leaf drawn gently asunder.

Fig. 14. Fig. 14. A small piece cut off that leaf.

Fig. 15. Fig. 15. The same piece magnified, in which the vessels have the appearance of a screw.

Fig. 16. Fig. 16. The appearance of these vessels as they exist in the leaf before they are stretched out.

5. *Of the Flower.*] It is needless here to mention any thing of the texture, or of the vessels, &c. of flowers, as they are pretty similar to those of the leaf. It would be foreign to our present purpose to take any notice of the characters and distinctions of flowers. These belong to the science of BOTANY, to which the reader is referred.

There is one curious fact, however, which must not be omitted, viz. That every flower is perfectly formed in its parts many months before it appears outwardly; that is, the flowers which appear this year are not properly speaking the flowers of this year, but of the last. For example, mezereon generally flowers in January; but these flowers were completely formed in the month of August preceding. Of this fact any one may satisfy himself by separating the coats of a tulip-root about the beginning of September; and he will find that the two innermost form a kind of cell, in the centre of which stands the young flower, which is not to make its appearance till the following April or May. Fig. 17. exhibits a view of the tulip-root when dissected in September, with the young flower towards the bottom. Fig. 17.

6. *Of the Fruit.*] In describing the structure of fruits,

a few examples shall be taken from such as are most generally known.

A *pear*, besides the skin, which is a production of the skin of the bark, consists of a double parenchyma or pulp, sap, and air-vessels, calculary and acetary.

The outer parenchyma is the same substance continued from the bark, only its bladders are larger and more succulent.

It is everywhere interspersed with small globules or grains, and the bladders respect these grains as a kind of centres, every grain being the centre of a number of bladders. The sap and air-vessels in this pulp are extremely small.

Next the core in the inner pulp or parenchyma, which consists of bladders of the same kind with the outer, only larger and more oblong, corresponding to those of the pulp, from which it seems to be derived. This inner pulp is much sourer than the other, and has none of the small grains interspersed through it; and hence it has got the name of *acetary*.

Between the acetary and outer pulp, the globules or grains begin to grow larger, and gradually unite into a hard stony body, especially towards the corculum or stool of the fruit; and from this circumstance it has been called the *calculary*.

These grains are not derived from any of the organical parts of the tree; but seem rather to be a kind of concretions precipitated from the sap, similar to the precipitation from wine, urine, and other liquors.

The core is a roundish cavity in the centre of the pear, lined with a hard woody membrane, in which the seed is inclosed. At the bottom of the core there is a small duct or canal, which runs up to the top of the pear; this canal allows the air to get into the core, for the purpose of drying and ripening the seeds.

Fig. 18.

Fig. 18. a transverse section of a pear, as it appears to the naked eye. A, the skin, and a ring of sap-vessels. B, the outer parenchyma, or pulp, with its vessels, and ligneous fibres interspersed. C, the inner parenchyma, or acetary, with its vessels, which are larger than the outer one. D, the core and seeds.

Fig. 19.

Fig. 19. a piece cut off, fig. 19.

Fig. 20.

Fig. 20. is fig. 19. magnified. A A A, the small grains, or globules, with the vessels radiated from them.

Fig. 21.

Fig. 21. a longitudinal section of the pear, showing a different view of the same parts with those of fig. 18. A the channel, or duct, which runs from the top of the pear to the bottom of the core.

In a *lemon*, the parenchyma appears in three different forms. The parenchyma of the rind is of a coarse texture, being composed of thick fibres, woven into large bladders. Those nearest the surface contain the essential oil of the fruit, which bursts into a flame when the skin is squeezed over a candle. From this outmost parenchyma nine or ten insertions or lamellæ are produced, which run between as many portions of the pulp, and unite into one body in the centre of the fruit, which corresponds to the pith in trunks or roots. At the bottom and top of the lemon, this pith evidently joins with the rind, without the intervention of any lamellæ. This circumstance shows, that the pith and bark are actually connected in the trunk and roots of plants, though it is difficult to demonstrate the connection, on account of the closeness of their texture, and the minuteness of their fibres. Many vessels are dispersed through the whole of this parenchyma; but the largest ones stand on the inner edge of the rind, and the outer edge of the pith, just at the two extremities of each lamella.

The second kind of parenchyma is placed between the rind and the pith; is divided into distinct bodies by the lamellæ; and each of these bodies forms a large bag.

These bags contain a third parenchyma, which is a cluster of smaller bags, distinct and unconnected with each other, having a small stalk by which they are fixed to the large bag. Within each of these small bags are many hundreds of bladders, composed of extremely minute fibres. These bladders contain the acid juice of the lemon.

Fig.

Fig. 22. a longitudinal section of a lemon. A A A, the rind with the vessels which contain the essential oil. B B, the substance corresponding to the pith, formed by the union of the lamellæ or insertions. C C, its continuation and connection with the rind, independent of the insertions.

Fig.

Fig. 23. a transverse section of the lemon. B B B, &c. the nine pulpy bags, or second parenchyma, placed between the rind and the pith; and the cluster of small bags, which contain the acid juice, inclosed in the large ones. C C, the large vessels that surround the pith. D D, two of the large bags laid open, showing the seeds, and their connection with the lamellæ or membranes which form the large bags.

Of the Perspiration of PLANTS*, and the quantity of moisture daily imbibed by them.*—These curious particulars have been determined with great accuracy by Dr Hales. The method he took to accomplish his purpose was as follows.—In the month of July, commonly the warmest season of the year, he took a large sun-flower three feet and a half high, which had been purposely planted in a flower-pot when young. He covered the pot with thin milled lead, leaving only a small hole to preserve a communication with the external air, and another by which he might occasionally supply the plant with water. Into the former he inserted a glass tube nine inches long, and another shorter tube into the hole by which he poured in the water; and the latter was kept close stopped with a cork, except when there was occasion to use it. The holes in the bottom of the pot were also stopped up with corks, and all the crevices shut with cement.—Things being thus prepared, the pot and plant were weighed for 15 several days; after which the plant was cut off close to the leaden plate, and the stump well covered with cement. By weighing, he found that there perspired through the unglazed porous pot two ounces every 12 hours; which being allowed for in the daily weighing of the plant and pot, the greatest perspiration, in a warm day, was found to be one pound 14 ounces; the middle rate of perspiration, one pound four ounces; the perspiration of a dry warm night, without any sensible dew, was about three ounces; but when there was any sensible though small dew, the perspiration was nothing; and when there was a large dew, or some little rain in the night, the plant and pot was increased in weight two or three ounces.

In order to know what quantity was perspired from a square inch of surface, our author cut off all the leaves of the plant, and laid them in five several parcels, according to their several sizes; and then measured the surface of a leaf of each parcel, by laying over it a large lattice made with threads, in which each of the little squares was $\frac{1}{4}$ of an inch; by numbering of which, he had the surface of the leaves in square inches; which, multiplied by the number of leaves in the corresponding parcels, gave the area of all the leaves. By this method he found the surface of the whole plant above ground to be 5616 square inches, or 39 square feet. He dug up another sun-flower of nearly the same size, which had eight main roots, reaching 15 inches deep and sidewise, from the stem. It had besides a very thick bush of lateral roots from the eight main roots, extending every way in a hemisphere about nine inches from the stem and main roots. In order to estimate the length of all the roots, he took one of the main roots with its laterals, and measured and weighed them; and then weighed the other seven with their laterals; by which means he found the sum of all their lengths to be 1448 feet. Supposing then the periphery of these roots at a medium to be 0.131 of an inch, then their surface will be 2276 square inches, or 15.8 square feet; that is, equal to 0.4 of the surface of the plant above ground. From calculations drawn from these observations, it appears, that a square inch of the upper surface of this plant perspires $\frac{1}{165}$ part of an inch in a day and a night; and that a square inch of the surface underground imbibed $\frac{1}{67}$ of an inch in the same time.

The quantity perspired by different plants, however, is by no means equal. A vine-leaf perspires only $\frac{1}{191}$ of an inch in 12 hours; a cabbage perspires $\frac{1}{80}$ of an inch in the same time; an apple-tree $\frac{1}{102}$ in 12 hours; and a lemon $\frac{1}{243}$ in 12 hours.

Of the circulation of the Sap in P*LANTS*.—Concerning this there have been great disputes; some maintaining, that the vegetable sap has a circulation analogous to the blood of animals; while others affirm, that it only ascends in the day-time, and descends again in the night. In favour of the doctrine of circulation it has been urged, that upon making a transverse incision into the trunk of a tree, the juice which runs out proceeds in greater quantity from the upper than the lower part; and the swelling in the upper lip is also much greater than in the lower. It appears, however, that when two similar incisions are made, one near the top and the other near the root, the latter expends much more sap than the former. Hence it is concluded, that the juice ascends by one set of vessels and descends by another. But, in order to show this clearly, it would be necessary first to prove that there is in plants, as in animals, some kind of centre from which the circulation begins, and to which it returns; but no such centre has been discovered by any naturalist; neither is there the least provision apparently made by nature whereby the sap might be prevented from descending in the very same vessels through which it ascends. In the lacteal vessels of animals, which we may suppose to be analogous to the roots of vegetables, there are valves which effectually prevent the chyle when once absorbed from returning into the intestines; but no such thing is observed in the vessels of vegetables; whence it must be very probable, that when the propelling force ceases, the juice descends by the very same vessels through which it ascended.—This matter, however, has been cleared up almost as well as the nature of the subject will admit of by the experiments of Dr Hales†. These experiments are so numerous, that for a particular account of them we must refer to the work itself; however, his reasoning against the circulation of the sap will be sufficiently intelligible without them. "We see (says he), in many of the foregoing experiments, what quantities of moisture trees daily imbibe and perspire: now the celerity of the sap must be very great, if that quantity of moisture must, most of it, ascend to the top of the tree, then descend, and ascend again, before it is carried off by perspiration.

"The defect of a circulation in vegetables seems in some measure to be supplied by the much greater quantity of liquor, which the vegetable takes in, than the animal, whereby its motion is accelerated; for we find the sun-flower, bulk for bulk, imbibes and perspires 17 times more fresh liquor than a man, every 24 hours.

"Besides, Nature's great aim in vegetables being only that the vegetable life be carried on and maintained, there was no occasion to give its sap the rapid motion, which was necessary for the blood of animals.

"In animals, it is the heart which sets the blood in motion, and makes it continually circulate; but in vegetables we can discover no other cause of the sap's motion but the strong attraction of the capillary sap-vessels, assisted by the brisk undulations and vibrations caused by the sun's warmth, whereby the sap is carried up to the top of the tallest trees, and is there perspired off through the leaves: but when the surface of the tree is greatly diminished by the loss of its leaves, then also the perspiration and motion of the sap is proportionably diminished, as is plain from many of the foregoing experiments: so that the ascending velocity of the sap is principally accelerated by the plentiful perspiration of the leaves, thereby making room for the fine capillary vessels to exert their vastly attracting power, which perspiration is effected by the brisk rarefying vibrations of warmth; a power that does not seem to be any ways well adapted to make the sap descend from the tops of vegetables by different vessels to the root.

"If the sap circulated, it must needs have been seen descending from the upper part of large gashes cut in branches set in water, and with columns of water pressing on their bottoms in long glass tubes. In both which cases it is certain that great quantities of water passed through the stem, so that it must needs have been seen descending, if the return of the sap downwards were by trusion or pulsion, whereby the blood in animals is returned through the veins to the heart; and that pulsion, if there were any, must necessarily be exerted with prodigious force, to be able to drive the sap through the finer capillaries. So that, if there be a return of the sap downwards, it must be by attraction, and that a very powerful one, as we may see by many of these experiments. But it is hard to conceive what and where that power is which can be equivalent to that provision nature has made for the ascent of the sap in consequence of the great perspiration of the leaves.

"The instances of the jessamine-tree, and of the passion-tree, have been looked upon as strong proofs of the circulation of the sap, because their branches, which were far below the inoculated bud, were gilded: but we have many visible proofs in the vine, and other bleeding trees, of the sap's receding back, and pushing forwards alternately, at different times of the day and night. And there is great reason to think that the sap of all other trees, has such an alternate, receding, and progressive motion occasioned by the alternacies of day and night, warm and cool, moist and dry.

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† *Vegetable Statics*, vol. i. p. 142.

"For the sap in all vegetables does probably recede in some measure from the tops of the branches, as the sun leaves them; because its rarefying power then ceasing, the greatly rarefied sap, and air mixed with it, will condense, and take up less room than they did, and the dew and rain will then be strongly imbibed by the leaves; whereby the body and branches of the vegetable which have been much exhausted by the great evaporation of the day, may at night imbibe sap and dew from the leaves; for by several experiments, plants were found to increase considerably in weight, in dewy and moist nights. And by other experiments on the vine, it was found that the trunk and branches of vines were always in an imbibing state, caused by the great perspiration of the leaves, except in the bleeding season; but when at night that perspiring power ceases, then the contrary imbibing power will prevail, and draw the sap and dew from the leaves, as well as moisture from the roots.

"And we have a farther proof of this by fixing mercurial gages to the stems of several trees which do not bleed, whereby it is found that they are always in a strongly imbibing state, by drawing up the mercury several inches: whence it is easy to conceive, how some of the particles of the gilded bud in the inoculated jessamine may be absorbed by it, and thereby communicate their gilding miasma to the sap of other branches; especially when, some months after the inoculation, the stock of the inoculated jessamine is cut off a little above the bud; whereby the stock, which was the counteracting part to the stem, being taken away, the stem attracts more vigorously from the bud.

"Another argument for the circulation of the sap is, that some sorts of the graffs will infect and canker the stocks they are grafted on: but by mercurial gages fixed to fresh cut stems of trees, it is evident that those stems were in a strongly imbibing state; and consequently the cankered stocks might very likely draw sap from the graff, as well as the graff alternately from the stock; just in the same manner as leaves and branches do from each other, in the vicissitudes of day and night. And this imbibing power of the stock is so great, where only some of the branches of a tree are grafted, that the remaining branches of the stock will, by their strong attraction, starve those graffs; for which reason it is usual to cut off the greatest part of the branches of the stock, leaving only a few small ones to draw up the sap.

"The instance of the ilex grafted upon the English oak, seems to afford a very considerable argument against a circulation. For, if there were a free uniform circulation of the sap through the oak and ilex, why should the leaves of the oak fall in winter, and not those of the ilex?

"Another argument against an uniform circulation of the sap in trees, as in animals, may be drawn from an experiment, where it was found by the three mercurial gages fixed to the same vine, that while some of its branches changed their state of protruding sap into a state of imbibing, others continued protruding sap; one nine, and the other thirteen days longer."

To this reasoning of Dr Hales we shall subjoin an experiment made by Mr Mustel of the Academy of Sciences at Rouen, which seems decisive against the doctrine of circulation. His account of it is as follows.—"On the 12th of January I placed several shrubs in pots against the windows of my hot-house, some within the house and others without it. Through holes made for this purpose in the panes of glass, I passed a branch of each of the shrubs, so that those in the inside had a branch without, and those on the outside one within; after this, I took care that the holes should be exactly closed and luted. This inverse experiment, I thought, if followed closely, could not fail affording sufficient points of comparison, to trace out the differences, by the observation of the effects.

"The 20th of January, a week after this disposition, all the branches that were in the hot-house began to disclose their buds. In the beginning of February there appeared leaves; and towards the end of it, shoots of a considerable length, which presented the young flowers. A dwarf apple-tree, and several rose-trees, being submitted to the same experiment, showed the same appearance then as they commonly put on in May; in short, all the branches which were within the hot-house, and consequently kept in the warm air, were green at the end of February, and had their shoots in great forwardness. Very different were those parts of the same tree which were without and exposed to the cold. None of these gave the least sign of vegetation; and the frost, which was intense at that time, broke a rose-pot placed on the outside, and killed some of the branches of that very tree which, on the inside, was every day putting forth more and more shoots, leaves, and buds, so that it was in full vegetation on one side, whilst frozen on the other.

"The continuance of the frost occasioned no change in any of the internal branches. They all continued in a very brisk and verdant state, as if they did not belong to the tree which, on the outside, appeared in the state of the greatest suffering. On the 15th of March, notwithstanding the severity of the season, all was in full bloom. The apple-tree had its root, its stem, and part of its branches, in the hot-house. These branches were covered with leaves and flowers; but the branches of the same tree, which were carried on the outside, and exposed to the cold air, did not in the least partake of the activity of the rest, but were absolutely in the same state which all trees are in during winter. A rose-tree, in the same position, showed long shoots with leaves and buds; it had even shot a vigorous branch upon its stalk; whilst a branch which passed through to the outside had not begun to produce any thing, but was in the same state with other rose-trees left in the ground. This branch is four lines in diameter, and 18 inches high.

"The rose-tree on the outside was in the same state; but one of its branches drawn through to the inside of the hot-house was covered with leaves and rose-buds. It was not without astonishment that I saw this branch shoot as briskly as the rose-tree which was in the hot-house, whose roots and stalk, exposed as they were to the warm air, ought, it should seem, to have made it get forwarder than a branch belonging to a tree, whose roots, trunk, and all its other branches, were at the very time frost-nipped. Notwithstanding this, the branch did not seem affected by the state of its trunk; but the action of the heat upon it produced the same effect as if the whole tree had been in the hot house."

Memoires de l'Acad. Royal des Sciences, an. 1708.

Of the Perpendicularity of Plants.—This is a curious phenomenon in natural history, which was first observed by M. Dodart, and published in an essay on the affectation of perpendicularity observed in the stems or stalks of all plants, in the roots of many, and even in their branches, as much as possible. Though almost all plants rise a little crooked, yet the stems shoot up perpendicularly, and the roots sink down perpendicularly: even those, which by the declivity of the soil come out inclined, or those which are diverted out of the perpendicular by any violent means, again redress and straighten themselves and recover their perpendicularity, by making a second and contrary bend or elbow without rectifying the first. We commonly look upon this affectation without any surprise; but the naturalist who knows what a plant is, and how it is formed, finds it a subject of astonishment.

Each seed we know contains in it a little plant, already formed, and needing nothing but to be unfolded; the little plant has its root; and the pulp which is usually separated into two lobes, is the foundation of the first food it draws by its root when it begins to germinate. If a seed in the earth, therefore, be disposed so as that the root of the little plant be turned downwards, and the stem upwards, and even perpendicularly upwards, it is easy to conceive that the little plant coming to unfold itself, its stalk and root need only follow the direction they have to grow perpendicularly. But we know that the seeds of plants, whether sown of themselves or by man, fall in the ground at random; and among the great variety of situations with regard to the stalk of their plant, the perpendicular one upwards is but one. In all the rest, therefore, it is necessary that the stalk rectify itself, so as to get out of the ground: but what force effects this change, which is unquestionably a violent action? Does the stalk find a less load of earth above it, and therefore go naturally that way where it finds the least obstacle? Were this so, the little root, when it happens to be uppermost, must also follow that direction, and mount up.

To account for two such different actions, M. Dodart supposes that the fibres of the stalks are of such a nature as to be contracted and shortened by the heat of the sun, and lengthened out by the moisture of the earth; and, on the contrary, that the fibres of the roots are contracted by the moisture of the earth, and lengthened by the heat of the sun. When the plantule therefore is inverted, and the root at the top, the fibres which compose one of the branches of the root are not alike exposed to the moisture of the earth, the lower part being more exposed than the upper. The lower must of course contract the most; and this contraction is again promoted by the lengthening of the upper, whereon the sun acts with the greatest force. This branch of the root must therefore recoil towards the earth, and, insinuating through the pores thereof, must get underneath the bulb, &c. By inverting this reasoning we discover how the stalk comes to get uppermost.

We suppose then that the earth attracts the root to itself, and that the sun contributes to its descent; and, on the other hand, that the sun attracts the stem, and the earth contributes to send it towards the same. With respect to the straightening of the stalks in the open air, our author imagines that it arises from the impression of external causes, particularly the sun and rain. For the upper part of a stalk that is bent is more exposed to the rain, dew, and even the sun, &c. than the under; and these causes, in a certain structure of the fibres, both equally tend to straighten the part most exposed by the shortening they successively occasion in it; for moisture shortens by swelling and heat by dissipating. What that structure is which gives the fibres such different qualities, or whereon it depends, is a mystery as yet beyond our depth.

M. de la Hire accounts for the perpendicularity of the stems or stalks of plants in this manner: he supposes that the root of plants draws a coarser and heavier juice, and the stem and branches a finer and more volatile one. Most naturalists indeed conceive the root to be the stomach of the plant, where the juices of the earth are subtilized so as to become able to rise through the stem to the extremity of the branches. This difference of juices supposes larger pores in the roots than the stalk, &c. and, in a word, a different contexture. This difference must be found even in the little invisible plant inclosed in the seed: in it, therefore, we may conceive a point of separation; such as, that all on one side, for example the root, shall be unfolded by the grosser juices, and all on the other side by the more subtile ones. Suppose the plantule, when its parts begin to unfold, to be entirely inverted, the root at the top, and the stalk below; the juices entering the root will be coarsest, and when they have opened and enlarged the pores so as to admit juices of a determinate weight, those juices pressing the root more and more will drive it downwards; and this will increase as the root is more extended or enlarged: for the point of separation being conceived as the fixed point of a lever, they will act by the longer arm. The volatile juices at the same time having penetrated the stalk, will give it a direction from below upwards; and, by reason of the lever, will give it more and more every day. The little plant is thus turned on its fixed point of separation till it become perfectly erect.

When the plant is thus erected, the stalk should still rise perpendicularly, in order to give it the more firm biding, and enable it to withstand the effort of wind and weather. M. Parent thus accounts for this effect: If the nutritious juice which arrived at the extremity of a rising stalk evaporate, the weight of the air which encompasses it on all sides will make it ascend vertically: but if, instead of evaporating, it congeal, and remain fixed to that extremity whence it was ready to go off, the weight of the air will give it the same direction; so that the stalk will have acquired a small new part vertically laid over it, just as the flame in a candle held in any way obliquely to the horizon still continues vertical by the pressure of the atmosphere. The new drops of juice that succeed will follow the same direction; and as all together form the stalk, that must of course be vertical, unless some particular circumstance intervene.

The branches, which are at first supposed to proceed laterally out of the stalk in the first embryo of the plant, though they should even come out in an horizontal direction, must also raise themselves upwards by the constant direction of the nutritious juice, which at first scarcely meets any resistance in a tender supple branch; and afterwards, even though the branch grow more firm, it will act with the more advantage; since the branch, being become longer, furnishes it with a longer arm or lever. The slender action of even a little drop becomes very considerable by its continuity, and by the assistance of such circumstances. Hence we may account for that regular situation and direction of the branches, since they all make nearly the same constant angle of 45° with the stem, and with one another.

M. Astruc accounts for the perpendicularity of the stems, and their redressing themselves, thus: 1. He thinks the nutritious juice arises from the circumference of the plant, and terminates in the pith: And, 2. That fluids, contained in tubes either parallel or oblique to the horizon, gravitate on the lower part of the tubes, and not at all on the upper. Hence it follows, that, in a plant placed either obliquely or parallel to the horizon, the nutritious juice will act more on the lower part of the canals than on the upper; and by this means they will insinuate more into the canals communicating therewith, and be collected more copiously therein: thus the parts on the lower side will receive more accretion and be more nourished than those on the upper, the extremity of the plant will therefore be obliged to bend upwards.

This principle brings the seed into its due situation at first. In a bean planted upside down, the plume and radicle may be seen with the naked eye shooting at first directly for about an inch; after which they begin to bend, the one downward, and the other upward. The same is the case in a heap of barley to be made into malt, or in a quantity of acorns laid to sprout in a moist place, &c. Each grain of barley and each acorn has a different situation; and yet every sprout tends directly upward, and every root downward, and the curvity or bend they make is greater or less as their situation approaches more or less to the direction wherein no curvature at all would be necessary. But two such opposite motions cannot possibly arise without supposing some difference between the two parts: the only one we know of is, that the plume is fed by a juice imported to it by tubes parallel to its sides, whereas the radicle imbibes its nourishment at every pore in its surface. When the plume therefore is either parallel or inclined to the horizon, the nutritious juice, feeding the lower parts more than the upper, will determine its extremes to turn upward, for the reasons before given. On the contrary, when the radicle is in the like situation, the nutritious juice penetrating through the upper part more copiously than through the under, there will be a greater accretion of the former than of the latter; and the radicle will therefore be bent downwards, and this mutual curvity of the plume and radicle must continue till such time as their sides are nourished alike, which cannot be till they are perpendicular.

Of the Food of P*LANTS*.—This hath been so fully discussed under the article AGRICULTURE, that little remains to be said upon the subject in this place. The method of making dephlogisticated or vital air *de novo*, is now so much improved, that numberless experiments may be made with it both on animals and vegetables. It appears, indeed, that these two parts of the creation are a kind of counterbalance to one another; and the noxious parts or excrements of the one prove salutary food to the other. Thus, from the animal body continually pass off certain effluvia, which vitiate or *phlogisticate* the air. Nothing can be more prejudicial to animal life than an accumulation of these effluvia: on the other hand, nothing is more favourable to vegetables than those excrementitious effluvia of animals; and accordingly they greedily absorb them from the earth, or from the air. With respect to the excrementitious parts of living vegetables, the case is reversed. The purest air is the common effluvium which passes off from vegetables; and this, however favourable to animal life, is by no means so to vegetable; whence we have an additional proof of the doctrine concerning the food of plants delivered under the article AGRICULTURE.

With regard to the effects of other kinds of air on vegetation, a difference of some consequence took place between Dr Priestley and Dr Percival. The former, in the first volume of his Experiments and Observations on Air, had asserted that fixed air is fatal to vegetable as well as to animal life. This opinion, however, was opposed by Dr Percival, and the contrary one adopted by Dr Hunter of York in the Georgical Essays, vol. v. The experiments related by these two gentlemen would indeed have been decisive, had they been made with sufficient accuracy. That this was the case, however, Dr Priestley denies; and in the 3d volume of his Treatise on Air has fully detected the mistakes in Dr Percival's Experiments; which proceeded in fact from his having used, not fixed air, but common air mixed with a small quantity of fixed air. His experiments, when repeated with the purest fixed air, and in the most careful manner, were always attended with the same effect, namely, the killing of the plant.

It had also been asserted by Drs Percival and Hunter, that water impregnated with fixed air was more favourable to vegetation than simple water. This opinion was likewise examined by Dr Priestley; however, his experiments were indecisive; but seem rather unfavourable to the use of fixed air than otherwise.

Another very remarkable fact with regard to the food of plants has been discovered by Dr Priestley; namely, that some of them, such as the willow, comfrey, and duckweed, are nourished by inflammable air. The first, he says, flourishes in this species of air so remarkably, that, "it may be said to feed upon it with great avidity. This process terminates in the change of what remains of the inflammable air into phlogisticated air, and sometimes into a species of air as good as common air, or even better; so that it must be the *inflammable principle* in the air that the plant takes, converting it, no doubt, into its proper nourishment."

Priestley on Air, vol. v. p.

What the followers of Stahl call phlogisticated air and inflammable air, are so closely allied to each other, that it is no wonder they should serve promiscuously for the food of plants. The reason why both are not agreeable to all kinds of plants, most probably is the different quantity of phlogistic matter contained in them, and the different action of the latent fire they contain; for all plants do not require an equal quantity of nourishment: and such as require but little, will be destroyed by having too much. The action of heat also is essentially necessary to vegetation; and it is probable that very much of this principle is absorbed from the air by vegetables. But if the air by which plants are partly nourished contains too much of that principle, it is very probable that they may be destroyed from this cause as well as the other; and thus inflammable air, which contains a vast quantity of that active principle, may destroy such plants as grow in a dry soil, though it preserves those which grow in a wet one. See VEGETATION.

Dissemination of P*LANTS*.—So great are the prolific powers of the vegetable kingdom, that a single plant almost of any kind, if left to itself, would, in a short time, overrun the whole world. Indeed, supposing the plant to have been only a single annual, with two seeds, it would, in 20 years, produce more than a million of its own species; what numbers then must have been produced by a plant whose seeds are so numerous as many of those with which we are acquainted? In that part of our work we have given particular examples of the very prolific nature of plants, which we need not repeat here; and we have made some observation on the means by which they are carried to distant places. This is a very curious matter of fact, and as such we shall now give a fuller account of it.

If nature had appointed no means for the scattering of these numerous seeds, but allowed them to fall down in the place where they grew, the young vegetables must of necessity have choked one another as they grew up, and not a single plant could have arrived at perfection. But so many ways are there appointed for the dissemination of plants, that we see they not only do not hinder each others growth, but a single plant will in a short time spread through different countries. The most evident means for this purpose are,

1. The force of the air.—That the efficacy of this may be the greater, nature has raised the seeds of vegetables upon stalks, so that the wind has thus an opportunity of acting upon them with the greater advantage. The seed-capsules also open at the apex, lest the ripe seeds should drop out without being widely dispersed by the wind. Others are furnished with wings, and a pappous down, by which after they come to maturity, they are carried up into the air, and have been known to fly the distance of 50 miles: 138 genera are found to have winged seeds.

2. In some plants the seed-vessels open with violence when the seeds are ripe, and thus throw them to a considerable distance; and we have an enumeration of 50 genera whose seeds are thus dispersed.

3. Other seeds are furnished with hooks, by which, when ripe, they adhere to the coats of animals, and are carried by them to their lodging places. Linnæus reckons 50 genera armed in this manner.

4. Many seeds are dispersed by means of birds and other animals; who pick up the berries, and afterwards eject the seeds uninjured. Thus the fox disseminates the privet, and man many species of fruit. The plants found growing upon walls and houses, on the tops of high rocks, &c. are mostly brought there by birds; and it is universally known, that by manuring a field with new dung, innumerable weeds will spring up which did not exist there before: 193 species are reckoned up which may be disseminated in this manner.

5. The growth of other seeds is promoted by animals in a different way. While some are eaten, others are scattered and trodden into the ground by them. The squirrel gnaws the cones of the pine, and many of the seeds fall out. When the loxia eats off their bark, almost his only food, many of their seeds are committed to the earth, or mixed in the morass with moss, where he had retired. The glandularia, when she hides up her nuts, often forgets them, and they strike root. The same is observable of the walnut; mice collect and bury great quantities of them, and being afterwards killed by different animals, the nuts germinate.

6. We are astonished to find mosses, fungi, byssus, and mucor, growing everywhere; but it is for want of reflecting that their seeds are so minute that they are almost invisible to the naked eye. They float in the air like atoms, and are dropped everywhere, but grow only in those places where there was no vegetation before; and hence we find the same mosses in North America and in Europe.

7. Seeds are also dispersed by the ocean, and by rivers, "In Lapland (says Linnæus), we see the most evident proofs how far rivers contribute to deposit the seeds of plants. I have seen Alpine plants growing upon their shores frequently 36 miles distant from the Alps; for their seeds falling into the rivers, and being carried along and left by the stream, take root there.—We may gather likewise from many circumstances how much the sea furthers this business.—In Roslagia, the island of Græsœa, Oeland, Gothland, and the shores of Scania, there are many foreign and German plants not yet naturalized in Sweden. The centaury is a German plant, whose seeds being carried by the wind into the sea, the waves landed this foreigner upon the coasts of Sweden. I was astonished to see the veronica maritima, a German plant, growing at Tornea, which hitherto had been found only in Græsœa: the sea was the vehicle by which this plant was transported thither from Germany; or possibly it was brought from Germany to Græsœa, and from thence to Tornea. Many have imagined, but erroneously, that seed corrupts in water, and loses its principle of vegetation. Water at the bottom of the sea is seldom warm enough to destroy seeds; we have seen water cover the surface of a field for a whole winter, while the seed which it contained remained unhurt, unless at the beginning of spring the waters were let down so low by drains, that the warmth of the sun-beams reached to the bottom. Then the seeds germinate, but presently become putrescent; so that for the rest of the year the earth remains naked and barren. Rain and showers carry seeds into the cracks of the earth, streams, and rivers; which last, conveying them to a distance from their native places, plant them in a foreign soil."

Amoen. Acad.

8. Lastly, some seeds assist their projection to a distance in a very surprising manner. The crupina, a species of centaury, has its seeds covered over with erect bristles, by whose assistance it creeps and moves about in such a manner, that it is by no means to be kept in the hand. If you confine one of them between the stocking and the foot, it creeps out either at the sleeve or neck-band, travelling over the whole body. If the bearded oat, after harvest, be left with other grain in the barn, it extricates itself from the glume; nor does it stop in its progress till it gets to the walls of the building. Hence, says Linnæus, the Dalecarlian, after he has cut and carried it into the barn, in a few days finds all the glumes empty, and the oats separate from them; for every oat has a spiral arista or beard annexed to it, which is contracted in wet, and extended in dry weather. When the spiral is contracted, it drags the oat along with it: the arista being bearded with minute hairs pointing downward, the grain necessarily follows it; but when it expands again, the oat does not go back to its former place, the roughness of the beard the contrary way preventing its return. If you take the seeds of equisetum, or fern, these being laid upon paper, and viewed in a microscope, will be seen to leap over any obstacle as if they had feet; by which they are separated and dispersed one from another; so that a person ignorant of

this property would pronounce these seeds to be so many mites or small insects.

We cannot finish this article without remarking, that many ingenious men believe that plants have a power of perception. Of this opinion we shall now give an account from the second volume of the Manchester Transactions, where we find some *speculations on the perceptive power of vegetables by Dr Percival*, who attempts to show, by the several analogies of organization, life, instinct, spontaneity, and self motion, that plants, like animals, are endued with the powers both of perception and enjoyment. The attempt is ingenious, and is ingeniously supported, but in our opinion fails to convince. That there is an analogy between animals and vegetables is certain; but we cannot from thence conclude that they either perceive or enjoy. Botanists have, it is true, derived from *anatomy* and *physiology*, almost all the terms employed in the description of plants. But we cannot from thence conclude, that their organization, though it bears an analogy to that of animals, is the sign of a *living principle*, if to this *principle* we annex the idea of *perception*; yet so fully is our author convinced of the truth of it, that he does not think it extravagant to suppose, that, in some future period, perceptivity may be discovered to extend even beyond the limits now assigned to vegetable life. Corallines, madrepores, millepores, and sponges, were formerly considered as fossil bodies: but the experiments of Count Marsigli evinced, that they are endued with life, and led him to class them with the maritime plants. And the observations of Ellis, Jussieu, and Peysonel, have since raised them to the rank of animals. The detection of error in long established opinions concerning one branch of natural knowledge, justifies the suspicion of its existence in others, which are nearly allied to it. And it will appear from the prosecution of our inquiry into the instincts, spontaneity, and self-moving power of vegetables, that the suspicion is not without foundation.

He then goes on to draw a comparison between the instincts of animals and those of vegetables; the calf, as soon as it comes into the world, applies to the teats of the cow; and the duckling, though hatched under a hen, runs to the water.

" Instincts analogous to these (says our author), operate with equal energy on the vegetable tribe. A seed contains a germ, or plant in miniature, and a radicle, or little root, intended by nature to supply it with nourishment. If the seed be sown in an inverted position, still each part pursues its proper direction. The plumula turns upward, and the radicle strikes downward into the ground. A hop-plant, turning round a pole, follows the course of the sun, from south to west, and soon dies, when forced into an opposite line of motion: but remove the obstacle, and the plant will quickly return to its ordinary position. The branches of a honeysuckle shoot out longitudinally, till they become unable to bear their own weight; and then strengthen themselves, by changing their form into a spiral: when they meet with other living branches, of the same kind, they coalesce, for mutual support, and one spiral turns to the right and the other to the left; thus seeking, by an instinctive impulse, some body on which to climb, and increasing the probability of finding one by the diversity of their course: for if the auxiliary branch be dead, the other uniformly winds itself round from the right to the left.

" These examples of the instinctive economy of vegetables have been purposely taken from subjects familiar to our daily observation. But the plants of warmer climates, were we sufficiently acquainted with them, would probably furnish better illustrations of this acknowledged power of animality: and I shall briefly recite the history of a very curious exotic, which has been delivered to us from good authority; and confirmed by the observations of several European botanists."

The doctor then goes on to give a description of the *dionæa muscipula* (B), for which see vol. vi. p. 32.; and concludes, that if he has furnished any presumptive proof of the instinctive power of vegetables, it will necessarily follow that they are endued with some degree of spontaneity. More fully to evince this, however, the doctor points out a few of those phenomena in the vegetable kingdom which seem to indicate spontaneity.—" Several years ago (says he), whilst engaged in a course of experiments to ascertain the influence of fixed air on vegetation, the following fact repeatedly occurred to me. A sprig of mint, suspended by the root, with the head downwards,

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(B) Dr Watson, the bishop of Landaff, who has espoused the same side of the question with Dr Percival (see the 5th vol. of his Chemical Essays), reasons thus on the motions of vegetables. " Whatever can produce any effect (says he) upon an animal organ, as the impact of external bodies, heat and cold, the vapour of burning sulphur, of volatile alkali, want of air, &c. are found to act also upon the plants called *sensitive*. But not to insist upon any more instances, the muscular motions of the dionæa muscipula, lately brought into Europe from America, seem far superior in quickness to those of a variety of animals. Now to refer the muscular motions of shell-fish and zoophytes to an internal principle of volition, to make them indicative of the perceptivity of the being, and to attribute the more notable ones of vegetables to certain mechanical dilatations and contractions of parts occasioned by external impulse, is to err against that rule of philosophizing which assigns the same causes for effects of the same kind. The motions in both cases are equally accommodated to the preservation of the being to which they belong, are equally distinct and uniform, and should be equally derived from mechanism, or equally admitted as criterions of perception.

" I am sensible that these and other similar motions of vegetables may by some be considered as analogous to the automatic or involuntary motions of animals; but as it is not yet determined amongst the physiologists, whether the motion of the heart, the peristaltic motion of the bowels, the contractions observable upon external impulse in the muscles of animals deprived of their heads and hearts, be attributable to an irritability, unaccompanied with perceptivity, or to an uneasy sensation, there seems to be no reason for entering into so obscure a disquisition; especially since irritability, if admitted as the cause of the motions of vegetables, must *à fortiori* be admitted as the cause of the less exquisite and discernible motions of being universally referred to the animal kingdom."

downwards, in the middle glass vessel of Dr Nooth's machine, continued to thrive vigorously, without any other pabulum than what was supplied by the stream of mephitic gas to which it was exposed. In 24 hours the stem formed into a curve, the head became erect, and gradually ascended towards the mouth of the vessel; thus producing, by successive efforts, a new and unusual configuration of its parts. Such exertions in the sprig of mint, to rectify its inverted position, and to remove from a foreign to its natural element, seems to evince a volition to avoid what was evil, and to recover what had been experienced to be good. If a plant, in a garden plot, be placed in a room which has no light except from a hole in the wall, it will shoot towards the hole, pass through it into the open air, and then vegetate upwards in its proper direction. Lord Kames relates, that, 'amongst the ruins of New Abbey, formerly a monastery in Galloway, there grows on the top of a wall a plane tree, 20 feet high. Straitened for nourishment in that barren situation, it several years ago directed roots down the side of the wall till they reached the ground ten feet below: and now the nourishment it afforded to these roots, during the time of descending, is amply repaid; having every year since that time made vigorous shoots. From the top of the wall to the surface of the earth, these roots have not thrown out a single fibre, but are now united into a pretty thick hard root.'

"The regular movements by which the sun-flower presents its splendid disk to the sun have been known to naturalists, and celebrated by poets, both of ancient and modern times. Ovid founds upon it a beautiful story; and Thomson describes it as an attachment of love to the celestial luminary.

> 'But one, the lofty follower of the sun,
> 'Sad when he sets, shuts up her yellow leaves,
> 'Drooping all night, and when he warm returns,
> 'Points her enamour'd bosom to his ray.'
>
> *Summer*, line 216.

Dr Percival next touches on motion; he mentions corallines, sea-pens*, oysters, &c. as endued with the power of motion in a very small degree, and then he speaks in the following manner. "Mr Miller (says he), in his late account of the island of Sumatra, mentions a species of coral, which the inhabitants have mistaken for a plant, and have denominated it *lalan-cout*, or sea-grass. It is found in shallow bays, where it appears like a straight stick, but when touched withdraws itself into the sand. Now if self-moving faculties like these indicate animality, can such a distinction be denied to vegetables possessed of them in an equal or superior degree? The water-lily, be the pond deep or shallow in which it grows, pushes up its flower-stems till they reach the open air, that the farina fecundans may perform without injury its proper office. About 7 in the morning the stalk erects itself, and the flowers rise above the surface of the water: in this state they continue till four in the afternoon, when the stalk becomes relaxed, and the flowers sink and close. The motions of the sensitive plant have been long noticed with admiration, as exhibiting the most obvious signs of perceptivity. And if we admit such motions as criteria of a like power in other beings, to attribute them in this instance to mere mechanism, actuated solely by external impulse, is to deviate from the soundest rule of philosophizing, which directs us not to multiply causes when the effects appear to be the same. Neither will the laws of electricity better solve the phenomena of this animated vegetable: for its leaves are equally affected by the contact of electric and non-electric bodies; show no change in their sensibility whether the atmosphere be dry or moist; and instantly close when the vapour of volatile alkali or the fumes of burning sulphur are applied to them. The powers of chemical stimuli to produce contractions in the fibres of this plant, may perhaps lead some philosophers to refer them to the *vis insita*, or irritability, which they assign to certain parts of organized matter, totally distinct from, and independent of, any sentient energy. But the hypothesis is evidently a solecism, and refutes itself. For the presence of irritability can only be proved by the experience of irritations, and the idea of irritation involves in it that of feeling.

"But there is a species of the order of decandria, which constantly and uniformly exerts a self-moving power, uninfluenced either by chemical stimuli, or by any external impulse whatsoever. This curious shrub, which was unknown to Linnæus, is a native of the East Indies, but has been cultivated in several botanical gardens here. I had an opportunity of examining it in the collection of the late Dr Brown. See HEDYSARUM.—I cannot better comment on this wonderful degree of vegetable animation than in the words of Cicero. *Inanimum est omne quod pulsu agitatur externo; quod autem est animal, id motu cietur interiore et suo.*

"I have thus attempted, with the brevity prescribed by the laws of this society, to extend our views of animated nature; to gratify the mind with the contemplation of multiplied accessions to the general aggregate of felicity; and to exalt our conceptions of the wisdom, power, and beneficence of God. In an undertaking never yet accomplished, disappointment can be no disgrace: in one directed to such noble objects, the motives are a justification, independently of success. Truth, indeed, obliges me to acknowledge, that I review my speculations with much diffidence; and that I dare not presume to expect they will produce any permanent conviction in others, because I experience an instability of opinion in myself. For, to use the language of Tully, *Nescio quomodo, dum lego, assentior; cum posui librum, assensio omnis illa elabitur.*—But this scepticism is perhaps to be ascribed to the influence of habitual preconceptions, rather than to a deficiency of reasonable proof. For besides the various arguments which have been advanced in favour of vegetable perceptivity, it may be further urged, that the hypothesis recommends itself by its consonance to those higher analogies of nature, which lead us to conclude, that the greatest possible sum of happiness exists in the universe. The bottom of the ocean is overspread with plants of the most luxuriant magnitude. Immense regions of the earth are covered with perennial forests. Nor are the Alps, or the Andes destitute of herbage, though buried in deeps of snow. And can it be imagined that such profusion of life subsists without the least sensation or enjoyment? Let us rather, with humble reverence, suppose, that vegetables participate, in some low degree, of the common allotment of vitality; and that our great Creator hath

* See *Pennatula, Ostrea, Mytilus*, &c.

apportioned good to all living things, 'in number, weight, and measure." See *Sensitive Plant*, Mimosa, *Dionæa Muscipula*, *Vegetable Motion*, *&c.*

To these ingenious and spirited observations, we shall subjoin nothing of our own, but leave our readers to determine for themselves (c). Speculations of this kind, when carried on by sober men, will never be productive of bad consequences; but by the subtle sceptic, or the more unwary inquirer, they may be made the engine of very dangerous errors. By this we do not mean to insinuate that the spirit of inquiry should be suppressed, because that spirit, in the hands of weak or of wicked men, may be abused. By those, however, who know the bad consequences that may be drawn, and indeed that have been drawn, from the opinions we have now given an account of, our caution will not be deemed impertinent. See Anatomy Vegetable, Supplement.

Plants growing on Animals. See *Insects giving root to Plants.*

Sexes of Plants. See Sexes and Botany.

Colours of Plants. See *Colour of Plants.*

Colours extracted from Plants. See *Colour-making.*

Method of Drying and Preserving Plants *for Botanists.*—Many methods have been devised for the preservation of plants: we shall relate only those that have been found most successful.

Withering's Botanical Arrangement, Introd. p. 48.

First prepare a press, which a workman will make by the following directions. Take two planks of wood not liable to warp. The planks must be two inches thick, 18 inches long, and 12 inches broad. Get four male and four female screws, such as are commonly used for securing sash windows. Let the four female screws be let into the four corners of one of the planks, and corresponding holes made through the four corners of the other plank for the male screws to pass through, so as to allow the two planks to be screwed tightly together. It will not be amiss to face the bearing of the male screws upon the wood with iron plates; and if the iron plates went across from corner to corner of the wood, it would be a good security against the warping.

Secondly, get half a dozen quires of large soft spongy paper (such as the stationers call *blossom blotting paper* is the best), and a few sheets of strong pasteboard.

The plants you wish to preserve should be gathered in a dry day, after the sun hath exhaled the dew; taking particular care to collect them in that state wherein their generic and specific characters are most conspicuous. Carry them home in a tin box nine inches long, four inches and a half wide, and one inch and a half deep. Get the box made of the thinnest tinned iron that can be procured; and let the lid open upon hinges. If any thing happen to prevent the immediate use of the specimens you have collected, they will be kept fresh two or three days in this box much better than by putting them in water. When you are going to preserve them, suffer them to lie upon a table until they become limber; and then they should be laid upon a pasteboard, as much as possible in their natural form, but at the same time with a particular view to their generic and specific characters. For this purpose it will be adviseable to separate one of the flowers, and to display the generic character. If the specific character depend upon the flower or upon the root, a particular display of that will be likewise necessary. When the plant is thus disposed upon the pasteboard, cover it with eight or ten layers of spongy paper, and put it into the press. Exert only a small degree of pressure for the first two or three days; then examine it, unfold any unnatural plaits, rectify any mistakes, and, after putting fresh paper over it, screw the press harder. In about three days more separate the plant from the pasteboard, if it is sufficiently firm to allow of a change of place; put it upon a fresh pasteboard, and, covering it with fresh blossom paper, let it remain in the press a few days longer. The press should stand in the sunshine, or within the influence of a fire.

When it is perfectly dry, the usual method is to fasten it down, with paste or gum water, on the right-hand inner page of a sheet of large strong writing-paper. It requires some dexterity to glue the plant neatly down, so that none of the gum or paste may appear to defile the paper. Press it gently again for a day or two, with a half sheet of blossom-paper betwixt the folds of the writing-paper. When it is quite dry, write upon the left-hand inner page of the paper the name of the plant; the specific character; the place where, and the time when, it was found; and any other remarks you may think proper. Upon the back of the same page, near the fold of the paper, write the name of the plant, and then place it in your cabinet. A small quantity of finely powdered arsenic, or corrosive sublimate, is usually mixed with the paste or gum-water, to prevent the devastations of insects; but the seeds of staves acre finely powdered will answer the same purpose, without being liable to corrode or to change the colour of the more delicate plants. Some people put the dried plants into the sheets of writing-paper, without fastening them down at all; and others only fasten them by means of small slips of paper, pasted across the stem or branches. Where the species of any genus are numerous, and the specimens are small, several of them may be put into one sheet of paper.

Another more expeditious method is to take the plants out of the press after the first or second day; let them remain upon the pasteboard; cover them with five or six leaves of blossom paper, and iron them with a hot smoothing iron until they are perfectly dry. If the iron be too hot, it will change the colours; but some people, taught by long practice, will succeed very happily. This is quite the best method to treat the orchis and other slimy mucilaginous plants.

(c) In the 2d volume of *Transactions of the Linnæan Society*, we find Dr Percival's reasoning very ably combated, as far as he draws his consequences from the external motions of plants; where it is argued, that these motions, though in some respects similar to those of animals, can and ought to be explained, without concluding that they are endowed either with perception or volition. Mr Townson concludes his paper in these words: "When all is considered (says he), I think we shall place this opinion among the many ingenious flights of the imagination, and soberly follow that blind impulse which leads us naturally to give sensation and perceptivity to animal life, and to deny it to vegetables; and so still say with Aristotle, and our great master Linnæus, *Vegetabilia crescunt & vivunt; animalai crescunt, vivunt, & sentiunt.*"

Another method is to take the plants when fresh gathered, and, instead of putting them into the press, immediately to fasten them down to the paper with strong gum-water: then dip a camel-hair pencil into spirit-varnish, and varnish the whole surface of the plant two or three times over. This method succeeds very well with plants that are readily laid flat, and it preserves their colours better than any other. The spirit varnish is made thus. To a quart of highly rectified spirit of wine put five ounces of gum sandarach; two ounces of mastich in drops; one ounce of pale gum elemi, and one ounce of oil of spike-lavender. Let it stand in a warm place, and shake it frequently to expedite the solution of the gums.

Where no better convenience can be had, the specimens may be disposed systematically in a large folio book; but a vegetable cabinet is upon all accounts more eligible. With the assistance of the following description a workman may readily make one. The drawers must have backs and sides, but no other front than a small ledge. Each drawer will be 14 inches wide, and 10 inches from the back to the front, after allowing half an inch for the thickness of the two sides, and a quarter of an inch for the thickness of the back. The sides of the drawers, in the part next the front, must be sloped off in a serpentine line, something like what the workmen call an *ogee*. The bottoms of the drawers must be made to slide in grooves cut in the uprights, so that no space may be lost betwixt drawer and drawer. After allowing a quarter of an inch for the thickness of the bottom of each drawer, the clear perpendicular space in each must be as in the following table.

I. Two-tenths of an inch.
II. One inch and two-tenths.
III. Four inches and six-tenths.
IV. Two inches and three-tenths.
V. Seven inches and eight-tenths
VI. Two inches and two-tenths.
VII. Two-tenths of an inch.
VIII. One inch and four-tenths.
IX. Two-tenths of an inch.
X. Two inches and eight-tenths.
XI. One inch and two-tenths.
XII. Three inches and five-tenths.
XIII. Two inches and four-tenths.
XIV. Three inches and eight-tenths.
XV. Three inches and four-tenths.
XVI. One inch and three-tenths.
XVII. Two inches and eight-tenths.
XVIII. Six-tenths of an inch.
XIX. Ten inches.
XX One inch and nine-tenths.
XXI. Four inches and four-tenths.
XXII. Two inches and six-tenths.
XXIII. One inch and two-tenths.
XXIV. Seventeen inches.

This cabinet shuts up with two doors in front; and the whole may stand upon a base, containing a few drawers for the reception of duplicates and papers.

Fossil PLANTS. Many species of tender and herbaceous plants are found at this day in great abundance, buried at considerable depths in the earth, and converted, as it were, into the nature of the matter they lie among; fossil wood is often found very little altered, and often impregnated with substances of almost all the different fossil kinds, and lodged in all the several strata, sometimes firmly imbedded in hard matter; sometimes loose; but this is by no means the case with the tenderer and more delicate subjects of the vegetable world. These are usually immersed either in a blackish slaty substance, found lying over the strata of coal, else in loose nodules of ferruginous matter of a pebble-like form, and they are always altered into the nature of the substance they lie among: what we meet with of these are principally of the fern kind; and what is very singular, though a very certain truth, is, that these are principally the ferns of American growth, not those of our own climate. The most frequent fossil plants are the polypody, spleenwort, osmund, trichomanes, and the several larger and smaller ferns; but besides these there are also found pieces of the equisetum or horse-tail, and joints of the stellated plants, as the clivers, madder, and the like; and these have been too often mistaken for flowers; sometimes there are also found complete grasses, or parts of them, as also reeds, and other watery plants; sometimes the ears of corn, and not unfrequently the twigs or bark, and impressions of the bark and fruit of the pine or fir kind, which have been, from their scaly appearance, mistaken for the skins of fishes; and sometimes but that very rarely, we meet with mosses and sea plants.

Many of the ferns not unfrequently found, are of very singular kinds, and some species yet unknown to us; and the leaves of some appear set at regular distances, with round protuberances and cavities. The stones which contain these plants split readily, and are often found to contain, on one side, the impression of the plant, and on the other the prominent plant itself; and, beside all that have been mentioned, there have been frequently supposed to have been found with us ears of common wheat, and of the maize or Indian corn; the first being in reality no other than the common endmost branches of the firs, and the other the thicker boughs of various species of that and of the pine kind, with their leaves fallen off; such branches in such a state cannot but afford many irregular tubercles and papillæ, and, in some species, such as are more regularly disposed.

These are the kinds most obvious in England; and these are either immersed in the slaty stone which constitutes whole strata, or in flatted nodules usually of about three inches broad, which readily split into two pieces on being struck.

They are most common in Kent, in coal-pits near Newcastle, and the forest of Dean in Gloucestershire; but are more or less found about almost all our coal-pits, and many of our iron mines. Though these seem the only species of plants found with us, yet in Germany there are many others, and those found in different substances. A whitish stone, a little harder than chalk, frequently contains them: they are found also often in a gray slaty stone of a firmer texture, not unfrequently in a blackish one, and at times in many others. Nor are the bodies themselves less various here than the matter in which they are contained: the leaves of trees are found in great abundance, among which those of the willow, poplar, white thorn, and pear trees, are the most common; small branches of box, leaves of the olive tree, and stalks of garden thyme, are also found there; and sometimes ears of the various species of corn, and the larger as well as the smaller mosses in great abundance.

These seem the tender vegetables, or herbaceous plants, certainly found thus immersed in hard stone, and buried at great depths in the earth: others of many kinds there are also named by authors; but as in bodies so imperfect errors are easily fallen into, these seem all that can be ascertained beyond mere conjecture.

Plants, method of preserving them in their original shape and colour. Wash a sufficient quantity of fine sand, so as perfectly to separate it from all other substances; dry it; pass it through a sieve to clear it from any gross particles which would not rise in the washing: take an earthen vessel of a proper size and form, for every plant and flower which you intend to preserve; gather your plants and flowers when they are in a state of perfection, and in dry weather, and always with a convenient portion of the stalk: heat a little of the dry sand prepared as above, and lay it in the bottom of the vessel, so as equally to cover it; lay the plant or flower upon it so as that no part of it may touch the sides of the vessel: sift or shake in more of the same sand by little upon it, so that the leaves may be extended by degrees, and without injury, till the plant or flower is covered about two inches thick: put the vessel into a stove, or hot-house, heated by little and little to the 50th degree; let it stand there a day or two, or perhaps more, according to the thickness and succulence of the flower or plant; then gently shake the sand out upon a sheet of paper, and take out the plant, which you will find in all its beauty, the shape as elegant, and the colour as vivid, as when it grew.

Some flowers require certain little operations to preserve the adherence of their petals, particularly the tulip; with respect to which it is necessary, before it is buried in the sand, to cut the triangular fruit which rises in the middle of the flower; for the petals will then remain more firmly attached to the stalk.

A hortus siccus prepared in this manner would be one of the most beautiful and useful curiosities that can be.

Moving Plant. See Hedysarum, Botany *Index.*

Sea Plants. See *Sea Plants.*

Sensitive Plant. See Mimosa, Botany *Index.*

Plant-Lice, Vine-fretters, or *Pucerons.* See Aphis, Entomology *Index.*

PLANTA, a Plant. See Plant.

Planta Fœminea, a female plant, is one which bears female flowers only. It is opposed to a *male* plant, which bears only male flowers; and to an *androgynous* one, which bears flowers of both sexes. Female plants are produced from the same seed with the male, and arrange themselves under the class of diœcia in the sexual method.

PLANTAGENET, the surname of the kings of England from Henry II. to Richard III. inclusive. Antiquarians are much at a loss to account for the origin of this name; and the best derivation they can find for it is, that Fulk, the first earl of Anjou of that name, being stung with remorse for some wicked action, went in pilgrimage to Jerusalem as a work of atonement; where, being soundly scourged with broom twigs, which grew plentifully on the spot, he ever after took the surname of *Plantagenet* or *broomstalk*, which was retained by his noble posterity.

PLANTAGO, Plantain; a genus of plants belonging to the tetrandria class. See Botany *Index.*—Of the plantain there are the following species: The common broad-leaved plantain, called *waybred* or *wayborn;* because it commonly grows by the wayside; the great hoary plantain, or lambs-tongue; the narrow-leaved plantain, or ribwort.

PLANTAIN. See Plantago, Botany *Index.*

Plantain Tree. See Musa, Botany *Index.*

PLANTATION, in the West Indies, denotes a spot of ground which a planter, or person arrived in a new colony, pitches on to cultivate for his own use, or is assigned for that purpose. However, the term *plantation* is often used in a term synonymous with colony. See Colony.

PLANTERSHIP, in a general sense, the business of a planter.

Plantership, in the West Indies, denotes the management of a sugar plantation, including not only the cultivation of the cane, but the various processes for the extraction of the sugar, together with the making of sugar-spirits. See Rum, Saccharum, and Sugar.

To effect a design so comprehensive, it is necessary for a planter to understand every branch of the art precisely, and to use the utmost attention and caution both in the laying down and executing of his plans. It is therefore the duty of a good planter to inspect every part of his plantation with his own eyes; to place his provisions, stores, and utensils, in regular order, and in safe repositories; that by preserving them in perfection, all kinds of waste may be prevented.

But as negroes, cattle, mules, and horses, are as it were the nerves of a sugar-plantation, it is expedient to treat that subject with some accuracy.

Maxims in Plantership.

Of Negroes, Cattle, &c.] In the first place, then, as it is the interest of every planter to preserve his negroes in health and strength; so every act of cruelty is not less repugnant to the master's real profit, than it is contrary to the laws of humanity: and if a manager considers his own ease and his employer's interest, he will treat all negroes under his care with due benevolence; for good discipline is by no means inconsistent with humanity: on the contrary, it is evident from experience, that he who feeds his negroes well, proportions their labour to their age, sex, and strength, and treats them with kindness and good nature, will reap a much larger product, and with infinitely more ease and self-satisfaction, than the most cruel taskmaster, who starves his negroes, or chastises them with undue severity. Every planter then who wishes to grow rich with ease, must be a good economist; must feed his negroes with the most wholesome food, sufficient to preserve them in health and vigour. Common experience points out the methods by which a planter may preserve his people in health and strength. Some of his most fruitful land should be allotted to each negro in proportion to his family, and a sufficient portion of time allowed for the cultivation of it; but because such allotment cannot in long droughts produce enough for his comfortable support, it is the incumbent duty of a good planter to have always his stores well filled with Guinea corn, yams, or eddoes, besides potatoes growing in regular succession: for plenty begets cheerfulness of heart, as well as strength of body; by which more work is effected in a day by the same hands than in a week when enervated by want and severity. Scanty meals may sustain life; but it is evident, that more is requisite to enable a negro or any other person to go through the necessary labours. He, therefore, who will reap plentifully, must plant great abundance of provisions as well as sugar canes; and it is nature's economy so to fructify the soil by the growth of yams, plantains, and potatoes, as to yield better harvests of sugar, by that very means, than can be produced by many other arts of cultivation. Plantains are the principal support of all the negroes in Jamaica; and are also much cultivated, at great expence of manure, in Barbadoes; but ought not to be solely depended upon in climates subject to hurricanes. A celebrated planter and economist of the last-mentioned island, who raised an immense fortune from very small beginnings only by planting, affirmed, that he fed constantly at least 300 negroes out of 12 acres of plantains. How that excellent produce came to be so long neglected in some of the islands it is hard to guess; but at present the neglect seems to be founded upon a vulgar error, that plantains cannot thrive in any other than low moist soils. In such places, no doubt, they flourish most luxuriantly; but yet they thrive and bear fruit abundantly on mountains and marshes, and in the driest black mould upon marle or rocks, and even in sharp gravelly soils, as may be evinced by numberless instances.

However plenty of wholesome food may be conducive to health, there are also other means, equally necessary to the strength and longevity of negroes, well worth the planter's attention; and those are, to choose airy dry situations for their houses; and to observe frequently that they be kept clean, in good repair, and perfectly water-tight; for nastiness, and the inclemencies of weather, generate the most malignant diseases. If these houses are situated also in regular order, and at due distances, the spaces may at once prevent general devastations by fire, and furnish plenty of fruits and potherbs, to please an unvitiated palate, and to purify the blood. Thus then ought every planter to treat his negroes with tenderness and generosity, that they may be induced to love and obey him out of mere gratitude, and become real good beings by the imitation of his behaviour; and therefore a good planter, for his own ease and happiness, will be careful of setting a good example.

Having thus hinted the duties of a planter to his negroes, let the next care be of cattle, mules, and horses. The planters of Barbadoes (who are perhaps the most skilful of all others, and exact to a nicety in calculations of profit and loss), are, with respect to their cattle, the most remiss of any in all the islands; as if the carriage of canes to the mill, and of plantation produce to the market, was not as essential as any other branch of plantership. At Barbadoes, in particular, the care of these animals is of more importance: because the soil, worn out by long culture, cannot yield any produce without plenty of dung. Some planters are nevertheless so ingeniously thrifty, as to carry their canes upon negroes heads; acting in that respect diametrically opposite to their own apparent interest, which cannot be served more effectually than by saving the labour of human hands, in all cases where the labour of brutes can be substituted; and for that end, no means of preserving those creatures in health and strength ought to be neglected.

The first care therefore is to provide plenty and variety of food. In crop-time, profusion of cane-tops may be had for the labour of carriage; but they will be more wholesome and nutritious if tedded like hay by the sun's heat, and sweated by laying them in heaps a few days before they are eaten. In this season of abundance, great ricks of cane-tops (the butt ends turned inwards) should be made in the most convenient corner of each field, to supply the want of pasturage and other food: and these are very wholesome if chopped into small parts, and mixed sometimes with common salt or sprinkled with melasses mixed with water; but yet the cattle require change of food to preserve them in strength; such as Guinea-corn, and a variety of grass, which every soil produces with a little care in moist weather; and indeed this variety is found necessary in all climes.

But since that variety is not to be had during those severe droughts to which hot climates are liable, and much less in those small islands which cannot furnish large tracts of meadow-lands for hay, the only resource is the fodder of cane-tops or tedded Guinea-corn leaves; which are very nutritious, and may be preserved in perfection for more than a whole year, provided the tops or Guinea-corn are well tedded for three or four hot days as they lie spread in the field; and then, being tied into bundles or sheaves, must lie in the hot sun for three or four days more, when they may be fit to be put up into ricks. The best method of making them is in an oblong figure, about 30 feet in length, and 16 or 18 feet wide; seven feet high at the sides, and from thence sloping like the roof of an house, the ridge of which must be thatched very carefully; for the sides may be secured from wet by placing the bundles with the butts upwards towards the ridge, in courses, and lapping the upper over the lower course.

The best method of forming those ricks is to place the first course of bundles all over the base one way; the second course reversely; and so alternately till the rick be finished.

When cattle are to be fed with this fodder, it must be observed to take down the bundles from the top, at the west end of the rick, to the bottom; for all these ricks must stand east and west lengthwise, as well to secure them from being overturned by high winds, as for the convenience of preserving them from wet, which cannot be done when ricks are made round. By this husbandry, an herd of cattle may be kept in strength, either in severe droughts, or in wet seasons when grass is purgative; and thus the necessity or expence of large pastures may be totally saved. The hay-knife used in England for cutting hay, answers for cutting ricks of tops.

The method of tedding Guinea-corn to make a kind of hay, will require a little explanation here. When Guinea-corn is planted in May, and to be cut down in July, in order to bear seed that year, that cutting, tedded properly, will make an excellent hay, which cattle prefer to meadow hay. In like manner, after Guinea-corn has done bearing seed, the after crop will furnish a great abundance of that kind of fodder which will keep well in ricks for two or three years.

The next care of a planter is to provide shade for his cattle; either by trees where they are fed in the heat of the day, if his soil requires not dung; or by building a flat shed over the pen where cattle are confined for making it. That such sheds are essentially necessary to the well-being of all animals in hot weather, is apparent to every common observer, who cannot fail of seeing each creature forsaking the most luxuriant pastures in the heat of the day for the sake of shade: thus convincing the owners, by instinctive argument, that shade is almost as necessary to the well-being of the brute creatures as food. Yet, notwithstanding that demonstration from the unerring course of nature, throughout all our islands (except in a very few instances), these poor creatures are exposed to the scorching sun-beams without mercy. Such inhuman neglect is not always so much the effect of inattention as of a mistaken notion that sheds are impedimental to the making of much dung; but a flat shed, covered with cane-trash, may be so made as to let rain pass through it without admission of sun-beams. This will do for cattle; but mules, which are spirited creatures, and work themselves by draught into a foaming heat, should be put into a warm stable, until quite cool: for turning them loose to pasture when so hot, is probably the cause of their destruction by the glanders.

If the care of providing shade for brute creatures is so much the duty and interest of their owners, how much more is it agreeable to the laws of humanity to provide shade for human creatures travelling upon the high-roads in this hot climate? Nothing surely of so much beauty costs so little expence as planting cocoa-nut or spreading timber trees in avenues along the highways, if each proprietor of the lands adjoining hath any taste of elegance, or feeling for other men: but both those kinds of trees will yield also great profit to the proprietor, by furnishing him with timber, when perhaps not otherwise to be had; or with a delicious milk, fitted by nature to cool the effervescence of the blood in this hot region; and also to improve the spirits made from sugar to the delicacy and softness of arrack. Cocoa-nut and cabbage trees are both very beautiful and shady, bearing round heads of great expansion, upon natural trunks or pillars of elegant proportion, and of such a height as to furnish a large shade, with a free circulation of air equally refreshing to man and beast.

The common objection of injury to canes by the roots of such trees growing on their borders, may be easily removed by digging a small trench between the canes and trees, which may intercept their roots, and oblige them to seek sustenance in the common road. Let it also be considered, besides the benefits above suggested, that the planter will thus beautify his estate to the resemblance of a most sumptuous garden. And probably that very beauty might not only render the islands more healthful to the inhabitants, by preserving them from fevers kindled by the burning sun-beams, but also much more fruitful, by making the weather more seasonable: for as, by cutting down all its wood, a hot country becomes more subject to excessive droughts; so, by replanting it in the manner above described, this inconvenience would probably be prevented.

Let then the planter be kind not only to his fellow-creatures, but merciful to his beasts; giving them plenty and variety of wholesome food, clear water, cool shade, and a clean bed, bleeding them after a long course of hard labour, currying their hides from filth and ticks (A); affording them salt and other physic when necessary; protecting them from the flaying rope-lashes of a cruel driver (who needs no other instrument than a goad); proportioning their labour to their strength; and by every art rendering their work as easy as possible. The general management of planters is not, perhaps, more defective in any other respect than in this: for, by pairing the cattle unequally, and by the drivers ill conduct in writhing to the right and left, the poor creatures are fatigued by much needless labour. A horse ought therefore to be harnessed before them as a leader. This docile creature, by being led in a straight line, will soon learn to be an unerring guide, and the cattle will follow in the same direction with united strength, and consequently with more effect and less fatigue to each individual.

The Portuguese of Madeira, by their poverty and scantiness of pasture, breed the smallest kind of cattle; and yet one yoke of them will draw a much greater weight than a pair of our largest oxen, solely by an equal exertion of their joint strength. That equality or evenness of draught is preserved by boring gimblet holes through their horns, within two inches of the points, and running a thong of leather, through those holes, so as to tie the horns of each pair at six inches distance from each other. By this ligature the pair of cattle are absolutely hindered from turning different ways, and draw in an even direction with united force. Thus it appears evidently from reason, as well as from experience, that the labour of our beasts may, by a little contrivance, be rendered more easy and effectual.

Of the Culture of various Soils.] In the British sugar-colonies there is as great a variety of soils as in any country of Europe; some naturally very rich or fruitful, yielding a luxuriant product with little labour or culture. This fruitful soil is of three kinds: a loose hazel mould mixed with sand, like that of St Christopher's, and is the best in the known world for producing sugar in great quantity, and of the best quality. The brick mould of Jamaica is somewhat of the same nature, and next in value; and then the various mixtures of mould and gravel, to be found in veins or plats over all the other islands. When any of these soils are exhausted of their fertility by long and injudicious culture, they may be restored by any kind of dung well rotted; for these (B) warm soils cannot bear hot unrotten dung, without being laid fallow for a considerable time after it. Another improvement is by sea-sand or sea-weed; or by digging in the cane-trash into steep lands, and by letting it lie to rot for some months. A third method is, by ploughing and laying it fallow; and the fourth method (the best of all), is by folding the fallows by sheep. But this can be practised only where there are extensive pastures; nor can the plough be employed where the soil abounds with large stones. In that case, however, the former method of digging in trash

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(A) One pound of native sulphur, a quart of lamp-oil, and the like quantity of hog's-lard, intimately mixed and made into an ointment, is a cure for the mange, lice, &c.

(B) These soils, which are naturally loose and upon marle, Mr Martin calls *hot soils;* and these, he says, have been much injured in some of the islands by dung hastily made with marle; but if the sediment of lees were thrown into these pens, after being turned over, it would much improve the dung.

trash will be nearly as effectual, though more expensive, by hand-labour or hoe-ploughing.

The next best soil for producing good sugar is a mould upon clay, which if shallow requires much culture and good labour, or its produce will be small in quantity, though of a strong grain and bright colour, so as to yield most profit to the refiner of any sugar, except that produced from an hazel or gravelly soil, as before mentioned. All the black mould soils upon marle are generally fruitful, and will take any kind of dung; but yield not so strong or large-grained sugar. Marle, however, of a white, yellow, or blue colour, or rich mould from washes, or ashes of every kind, are excellent for every strong soil, as the chief ingredient in the compost of dung: either of them will do alone for stiff lands; but the yellow and chocolate marle are the most soapy, and the richest kind of manure (except fine mould) for all stiff lands. If these are well opened, pulverized by culture, and mixed with hot dung, or any kind of loose earth or marle, they will produce as plentifully as lighter soils: and all kinds of clay-soils, except that of a white colour, have these two advantages above the finest gravel soils, that they do not scorch soon by dry weather; and never grow weary of the same manure, as most other soils do.

The extraordinary hand-labour bestowed in making dung, may be saved by the art of caving, now in general use in England. Ten mules or horses, and two light tumbrels with broad wheels, and ten able negroes, may, by the common use of spades, shovels, and light mattocks or grubbing hoes, make more dung than 60 able negroes can do in the present methods.

If marl lies upon rising grounds, or in hillocks, as it often does, the pit is to be opened at the foot of the declivity; which being dug inwards, till the bank is three feet high, then it is to be *caved* thus. Dig an hollow space of 12 or 18 inches deep under the foot of the bank; then dig into each side of it another perpendicular cut of the same depth, and 18 inches wide from the top of the bank to the bottom: that being finished, make a small trench a foot or two from the brink of the bank; pour into it water till full; and when that is done, fill it again, till the water soaking downward makes the marle separate and fall down all at once. This may be repeated till the pit rises to 50 feet high; and then many hundreds of cart-loads of marle may be thrown down by four negroes in two hours; from whence it may be carted into cattle pens, or laid out upon lands, as occasion requires. Five or six negroes with spades or shovels will keep two or three tumbrels employed according to the distance of cartage: and thus as much dung may be made by ten negro men as will dung richly at least 70 or 80 acres of land every year, and laid out also with the assistance of cattle-carts: An improvement highly worthy every planter's consideration, when negroes and feeding them are so expensive; and this is no speculation, but has been confirmed by practice. In level lands, the same operation may be as effectual, provided the mouth of the pit be opened by gradual descent to any depth: but when marle is to be found on the sides of hills, the operation is less laborious for the horses. But if the surface of the marle-pits (as it often happens) be covered with clay or stiff soil, so that the water cannot quickly soak from the trench above; in that case, pieces of hard wood, made like piles, four feet long, and four inches square, pointed at one end, and secured at the other square head by an iron clamp, may be driven by heavy mauls into the trench, as so many wedges, which will make the caved part tumble down: but a skilful eye must watch the last operation, or the labourers may be buried or hurt.

But then clay soils that are level, and subject to be drowned, or to retain water in stagnated pools, can never be made fruitful by any kind of manure, without being first well drained: for water lying upon any soil will most certainly transform it to a stiff unfruitful clay; as appears evidently by the bogs of Ireland, the fens of Lincoln and Cambridgeshire, and even by the ponds of Barbadoes situated in the deepest and lightest black mould; for that fine soil being washed into those ponds, becomes the stiffest black clay, not fit even for an ingredient in dung, until it has been laid dry, and exposed to the sun for a whole year: but when these bogs and fens are well drained, they become the most fruitful soils, Natural clay the celebrated Boerhaave thinks the fattest of all soils; but then it must be opened by culture, marle, or sandy manures. It is hard to conjecture how the opinion prevailed in the British plantations, that sandy gut-mould was most unfit for clay-soils, as being the means of binding them to the compactness of brick; whereas it is proved, from long experience, to be one of the best means of opening clay soils, and rendering them abundantly fruitful. Brick is made of *clay alone;* no sand being used in it, farther than to sprinkle the board, on which it is moulded into shape. From repeated experience it appears, that a mixture of sand in gut-mould is the best of all manure for stiff and barren clay-lands; provided they be well drained, by throwing the whole soil into round ridges of 12 feet wide, with furrows of three feet wide between each ridge. And this is done with little more hand-labour than that of hoe-ploughing well in the common way. For if a piece of land be marked in lines at seven feet and a half distance from each other, and the labourers are set in to hoe-plough at the second line, hauling back each clod 12 inches; half the ridge, and near half the furrow, is made at the same time: and thus a piece of land may be round-ridged, and the furrows all made at once, by the common operation of hoe-ploughing, provided the digger drives his hoe up to the eye at every stroke. Hoe-ploughing in clay soils that have lain long under water, is indeed hard labour; but it will every year grow the lighter by being well drained by round-ridging: and in the meanwhile the labour may be rendered much more easy by the plough conducted by the lines above described. As therefore sandy mould is the best manure for stiff clay, so, by parity of reason, confirmed by long experience, stiff clay is the best manure for sandy or chaffy soils.

The method of round-ridging before described, is, by several years experience, found the most essential improvement of flat clayey soils: and yet there are some who will prefer speculation to ocular demonstration, fancying that all kinds of ridges will carry off the mould in heavy rains. The fact is otherwise in clay soils: and plain reason, without experience, vouches, that where great confluxes of water are divided into many small rills, the force is broken; and therefore less mould carried off the land. Another objection made to round ridgeing, is that by digging much clay to form the sides of the ridge, the soil is impoverished: but this objection stands good only against those ridges which are raised too high, and made too broad; but if land is ridged in the manner before directed, that is, 12 feet broad, and not above six or eight inches higher in the middle than at the sides, the objection vanishes. Ridges were never proposed for light soils or steep lands; and even in flat soils upon loam they should be made with great caution, because *loam melts away by water*. But there are poachy lands of a white clay, even upon small descents, too retentive of water; these may certainly be improved much by ridges of 12 feet wide, as above described, without fear of washes.

But supposing, as the objection urges, that a little clay should be turned up at the sides of such ridges, can it not be manured somewhat more than the other parts with marle or sandy mould, so as to become equally good with any other part of the soil? And is not this well worth the labour, since round-ridging not only improves the soil by draining it to a surprising degree, but adds one-fifth part to the depth of the staple? And will not a ridge made a little rounding, throw off the water much better than a flat ridge?

The general maxim of not burning cane-trash (which may be called the *stubble of cane-lands*) upon any kind of soil is surely a great mistake; as may be evinced by observing the contrary practice of the best husbandmen in England, where burn-baiting or bastard burn-baiting is found by experience an admirable method of fertilizing cold, stiff, or clayey lands. It must indeed be a constant practice, not only for the sake of contributing to warm and divide the soil, but as the only effectual means of destroying pernicious insects, and weeds of various kinds, such as French weed, wild pease, and wild vines.

Soon after the disuse of burning trash upon our land in the islands, the blast made its first appearance with incredible devastation: to revive that practice therefore seems to be the most obvious means of expelling it. It may be presumed that the disuse of burning trash was founded upon the mistaken notion of burn-baiting, which is turning up a thick sod of very dry, light, and shallow soils, and burning the whole superficies or staple to ashes. This practice the writers upon husbandry condemn universally, and very justly: for though by this practice the land will produce two or three crops more plentifully than ever, yet the soil is blown away by the wind, and the substratum being generally a hungry gravel or chalk, can never be restored to fertility by the common arts of husbandry. But surely this has no resemblance to our superficial burning of the little trash we can spare from dung: and though this method of burn-baiting light and shallow soils be justly condemned, yet the best writers recommend that very practice in cold, moist, and heavy soils, as is observed above; and long experience justifies it.

Deep mould upon clay or loam being subject to the grub-worm (c), will not take any kind of dung, till perfectly rotten, except that of the sheep-fold; which is the best manure for all kinds of light soils, and is of all others the least expensive, as not requiring hand-labour. But the use of the fold is impracticable in any island not abounding with large savannas or sheep pastures, as in Jamaica.

Those soils therefore which are subject to the grub, and must be fertilized by common dung, which is a proper nest for the mother-beetle to deposite its eggs, must be well impregnated with the brine of dissolved salt, after the dung is first cut up; two large hogsheads of salt will make brine enough for a dung-pen of 50 feet square.

This cure for the grub is a late discovery; and which has been attended with success, so far as the experiment is made. But though it proves effectual to destroy that pernicious insect in plant-canes, it probably will not be sufficient to save rattoons, without a new application of salt in powder; because the first brine must be washed away by the time when rattoons spring up.

The planter who would save his rattoons from the grub ought therefore to cut off the heads of his stools with sharp hoes three inches below the surface of the soil, and then strew an handful of salt round each stool, and cover it up to a level with fine mould taken from the edges.

In soils where there is no grub, and the planter wishes to have very good rattoons, let him, as soon as his canes are cut, draw all the trash from the stools into the alternate spaces, if planted in that manner; or into the furrows, if his land be round-ridged; and then cut off the head of his stools with sharp hoes, as above directed. Experience has shown the advantage of this practice, and reason demonstrates the great benefit of the rattoon-sprouts rising from three inches below the surface, instead of superficial shoots which come to nothing, and only starve the strong sprouts. Besides, the stubs which are left upon the stools after the canes are cut, canker, and rot the stools; which is one reason why good rattoons are uncommon in soils long cultivated. Yet it is the opinion of some, that by hoe-ploughing and even dunging rattoons, the produce might be as good plant-canes, which would save the labour of holing and planting so often as planters commonly do.

Fallowing is of incredible advantage to every soil, not only by being divided into the minutest parts, but also by imbibing those vegetative powers with which the air is impregnated by the bountiful hand of Providence, whenever rain falls. What those powers are has been explained under the articles AGRICULTURE and PLANT; and experience evinces, that the tender vegetables of the earth are invigorated more by the smallest shower of rain, than by all the water which human art can bestow. Let it therefore be a constant maxim of the planter, never to plant his ground until the soil is well mellowed by fallowing, even though he bestows upon it a due proportion of dung: we say a due proportion; for too much will force up rank canes, which never yield good sugar; and though some advantage may be reaped from the rattoons,

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(c) This pernicious insect is most apt to engender in dung made from mill-trash, which therefore never ought to be put into dung compost or still ponds; but after being burnt, the ashes will be as good as any other kind. Round-ridging, with manure of unwet ashes, sea-sand, or lime, or dry marle, kills the grub.

toons, yet it will be found by experience not to compensate the loss by the plants. In stony or steep soils, where the plough cannot be used, or where a sufficient strength of cattle cannot be supported for that purpose, hand-labour or hoe-ploughing must be substituted: but even in that case, much labour may be saved by spreading the dung according to the English husbandry, and digging it into the soil. To evince this truth, let any planter compute his negroes labour of distributing dung by baskets, and by spreading it with dung-forks; and then judge for himself by one single experiment which is the most profitable.

But if some planters are so devoted to the old custom of distributing dung by baskets instead of wheel-barrows in level ground, or hand-barrows in uneven land, by which three times the labour may be accomplished in the same time and by the same hands; let them at least save much of their hand-labour, by the following method of laying out dung, before the distribution by baskets.

In holing a piece of land, let a space be left after 80 holes from the first interval, and then the like space after 80 holes throughout the whole plat, which spaces must run exactly parallel to the intervals on the right and left of the holes. Into these spaces the dung may be carted, even before it be rotten (D), at the most leisure times, and covered with mould or cane-trash, to prevent exhalation; and in such quantity as will suffice only to dung a row of 40 holes, from the point opposite to each side of it. In the intervals at each side of the cane-piece, which are parallel to those spaces, there must be dung enough carted to manure a row of 40 holes, and covered in like manner.

By thus placing the dung or gut-mould, it is evident at the first sight, that the farthest distance cannot be above 40 holes in distributing the dung: and in case it be not sufficiently rotten for present use, it may be distributed even in dry weather, and covered by the bank; which will both prevent its spirit from exhalation, and occasion it to rot sooner, which is no small advantage. Moreover, by being thus laid out at the most leisure times, and covered with the banks, the dung will be more intimately mixed with the soil, and therefore continue to nourish the plant for a longer time than if laid as usual at the bottom of the holes. A farther advantage of thus distributing the dung, and covering it, results from the more expeditious planting the land after a short or sudden shower: for the labour of covering the dung, and uncovering it when the land is planted, however it may appear in speculation, is in practice a trifle; and besides all the other advantages arising by the distribution of dung from the spaces above described, this is not the least, that not a bank is trodden under foot. But it is evident, that by distributing the dung with baskets in the present method, the soil is much trampled under foot; and by that means, the very end of hoe-ploughing, or loosening the soil, is much defeated. In like manner, by the present method of hoe-ploughing, the same ill effect is produced; for as the negroes hoe-plough or dig the soil directly forward, so they must necessarily tread the ground as fast as they dig it: whereas by putting the labourers to dig sidewise, no one puts a foot upon the soil after it is dug; and by lining the land before it is hoe-ploughed, each negro may have an equal share to dig. The only difficulty of hoe-ploughing sidewise is in first setting the negroes to that work; but it may be done without loss of time when working in a contiguous field. Whether hoe-ploughing before or after the land be holed for canes is most eligible, experience must determine; but certainly both operations will be most effectual: and therefore it will be advisable (E), first to plough the soil where the land will admit the plough; and where it will not, to hoe-plough it with or without dung, as requisite; then let it lie fallow till perfectly mellowed; then hole and plant it; and instead of weeding in the usual manner, let the weeds in all the spaces be dug into the soil: but as this is not to be done so well with the hoe, it is submitted to future experience, whether the dexterous use of spades, as in England, will not answer the purpose much better, and with equal dispatch. But whatever method is preferred, most certain it is, that by loosening the soil in all the spaces between the young canes after being come up, their fibres will more easily expand on every side, and acquire more nutrition to invigorate their growth. But where the planter grudges this labour, by thinking it needless in a rich loose soil, he may dispatch more weeding-work by the Dutch hoe than by any other; which being fastened upon the end of a stick, is pushed forward under the roots of the small weeds, in such a manner as to cut them up a little below the surface of the soil, and will do more execution at one shove than can be done at three strokes of the common hoe; but there is yet another practice of the horse-hoe plough, whereby all weeds growing in rows between beans and pease, are extirpated with incredible ease and expedition. It is a very simple machine, drawn by one or two horses, consisting of a pair of low wheels turning upon a common axis; from whence two square irons are let down at equal distances, and triangular hoes made at the ends, the points of the triangles being placed forward, and so fixed as to cut all weeds an inch below the surface, in the same manner as the Dutch garden-hoe above-mentioned. By this machine a man and a boy, with two horses or mules, will clear perfectly all the spaces of a field of ten acres in two days, and may be of admirable use in all loose and dry soils in the sugar-islands: for while two horses or mules draw in the space before each other, the wheels pass on the outside of each row of canes, without doing the least injury, while the plough-

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(D) In order to make dung rot the sooner, much labour is bestowed in digging and turning it over by hoes: but two-thirds of that labour may be saved by the use of hay-knives; six of which, used dexterously, will cut up a pen in less time than 60 negroes can do by hoes: but hay knives cannot be used where gritty mould is employed in pens.

(E) Deep and loose soils may be ploughed with a small strength of cattle or mules: but stiff lands in hot climates require more strength of cattle than can be maintained in the small pastures of the planters; for if those strong soils are either too wet or too dry (as is generally the case), ploughing is impracticable.

plough-holder attends to his business. In stiff soils which require draining, neither the horse-hoe plough nor the Dutch hoe can be proper; or any other instrument so effectual as the spade used in the manner above hinted, where the staple is deep.

But where the staple of land is shallow, care must be taken not to dig much below it, according to the universal opinion of all the best writers, supported by the experience of 100 years. Yet some good planters are fallen into the contrary practice, and dig up stiff clay far below the staple. This, Mr Martin says, was done in his own lands, during his absence, by injudiciously ploughing below the staple; and so injured the soil, that all the arts of culture for many years hardly retrieved its former fertility. Indeed, where the staple is shallow, upon a fat clay, the turning up a little of it at a time, from the bottom of the cane-holes, and mixing it with rich hot dung, made of marle, or sandy mould, which may take off its cohesive quality, will in due time, and by long fallow, convert it into good soil: but if stiff clay be turned up, without any such mixture, in large quantities, it will infallibly disappoint the operator's hopes: for though solid clay will moulder, by exposure, to a seeming fine earth, yet it will return to its primitive state very soon after being wet, and covered from the external air, if not divided, as above suggested.

After all, the common horse-hoeing plough drawn by two mules in a line before each other, or the hand-hoe in common use, will answer the purpose very well, where the lands are planted in Mr Tull's method; that is, where the spaces are equal to the land planted, in the following manner.

Suppose six feet planted in two rows of canes, and six feet of land left as a space unplanted; and so a whole piece of land, planted in alternate double rows (F), with equal spaces, may be hoe-ploughed with ease, as before hinted; and that at any time during the growth of canes, when it is most convenient to the planter, which is a considerable advantage; and yet it is the least of all attending this method of culture: for, by leaving these spaces, the canes will have both more air and sun: by hoe-ploughing them, the roots of each double row will have large room for expansion, and consequently, by gaining more nutriment, will grow more luxuriantly: by these spaces the canes may be cleaned from the blast with much more ease and convenience; and will serve as proper beds to plant great corn, without the least injury to the canes; as well as to contain the trash taken off the land, where, by rotting, and being hoe-ploughed into the soil, it will wonderfully enrich it, and will fit it to be planted immediately after the canes in the neighbouring double rows are cut down. Besides all these admirable advantages of planting the land in alternate double rows with equal spaces, the canes, when at full age, may be easily stripped of their trash, and by that means the juice rendered so mature as to yield double the produce, and much better sugars than unstripped canes. This method of culture may be recommended for all kinds of soil: for as by this practice the rank luxuriant canes will be more matured, so the poor soils will be rendered more fruitful; and as the roots of the canes which expand into these spaces will be kept moist by being covered with rotten trash, so they must bear dry weather much longer in the burning soils. In those low lands which require draining by furrows, the alternate double rows and spaces must be made cross the ridges; by which means those spaces, being hoe-ploughed from the centre to the sides, will be always preserved in a proper state of roundness. By this method of planting, the canes may be so well ripened as to yield double the quantity of sugar of canes planted in the close manner; which saves half the labour of cartage, half the time of grinding and boiling, and half the fuel, besides yielding finer sugar.

Yet, how well soever the method of planting in single or double alternate rows has succeeded in the loose and stiff soils, experience has shown that it is a wrong practice in stiff lands that are thrown into round or flat ridges: for these being most apt to crack, the sun-beams penetrate soon to the cane-roots, stop their growth, and have an ill influence upon the sugar. It is therefore advisable to plant such lands full, but in large holes, of four feet, by five feet towards the banks: after the plant-canes are cut, to dig out one, and leave two rows standing, hoe-ploughing the spaces after turning all the trash into furrows till almost rotten; for if the trash is drawn upon the hoe-ploughed spaces, they will hardly ever moulder, at least not till the trash is quite rotten. This is an infallible proof from experience of how little advantage trash is to the soil, unless it be in great droughts, to keep out the intense sun-beams: for, in all other respects, it prevents that joint operation of the sun and air, in mouldering and fructifying the soil, as has been proved by repeated experiments.

But in flat stiff soils that are properly drained by round-ridging, no culture prevents cracking so effectually as hoe-ploughing into them a quantity of loose marle, of which that of a chocolate or of a yellow colour is best; and it will be still much better, by lying upon the land, in small heaps, or in cane-holes, for some time, to imbibe the vegetative powers of the air before it is intimately mixed with the soil.

As to the manner of planting canes, the general practice of allowing four feet by five to a hole, and two fresh (G) plants, is found by common experience to be right and good in alternate rows. But the following precautions are necessary to be observed. First, let all the cane-rows run east and west, that the trade-wind may pass freely through them; because air and sunshine are as conducive to the growth and maturation of sugar-canes as of any other vegetable. Secondly, let not any accession of mould be drawn into hills round the young canes, except where water stagnates (H); because the fibres which run horizontally, and near the surface, are much

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(F) In stiff lands, the single alternate rows of four feet distance, as preventive of much labour in weeding, are found best; and also yield more sugar by the acre; and are less apt to be affected by drought.

(G) It is an odd fancy that stale plants grow best, when both reason and experience vouch that the most succulent plants are best: one good plant in the centre of a large hole is sufficient when the land is full holed.

(H) The stagnation of water in pools (usual in stiff level lands) is the most injurious circumstance attending it; for much broken and spoiled by that practice. Thirdly, let the sugar-canes be cut at their full maturity: which, in a dry loose soil, is generally at the end of 14 or 15 months after being planted; but in cold clay-soils, not till 16 or 17 months. Fourthly, as the cane-rows run east and west in as proper a direction as possible for cartage to the sugar-work, so canes must be cut the contrary way if the planter expects any great produce from his rattoons: for by beginning to cut canes at the part of his field most remote from the works, the carts cannot often pass over the same tract, and consequently the cane-stools cannot be injured, more especially if he takes due care to cut the canes very close to their roots; for, by leaving a long stub (which must perish) the cane-stools are much injured. It may be objected to the practice of cutting canes transversely to the rows, that the negroes labour will not be so equally divided: but let every man consider both sides of the question, and be determined by his own experience; and then he will be convinced, that it matters very little which way he cuts straight standing canes; but in cases where the sugar-canes lean, or are lodged by preceding high winds, it is a point of great importance to place the labourers so as to cut the canes first at the roots, and then, drawing them, cut off the tops: for thus by two strokes each cane will be cut; and twice the quantity cut in the same time, and by the same hands, more than by cutting in any other direction. In round ridged land, it is proper to cut canes in the same direction of the ridges, throwing the tops and trash into the furrows to render the cartage easy, and to preserve the ridges in their proper form.

It is almost needless to suggest the expediency of planning the cane-pieces of a plantation in exact squares, so that the intervals may intersect at right angles; since such regularity is not only more beautiful, more safe in case of accidental fires, and a better disposition of the whole for dividing and planting one third or fourth part of a plantation every year, but also much easier guarded by a few watchmen: for one of these walking in a line from east to west, and the other from north to south, look through every avenue, where the most subtle thief cannot escape the watchful eye. And if the intervals surrounding the boundary of a regular plantation be made 24 feet wide, the proprietor will receive ample recompense for so much land, by the security of his canes from fires kindled in the neighbourhood, and by planting all that land in plantain-trees, which may at once yield food and shade to the watchmen, who by that means can have no excuse for absence from their proper stations. But as fuel grows very scarce in most of our islands, it is also expedient to plant a logwood or flower-fence in all the boundaries of every plantation, which, being cut every year, will furnish good store of faggots. Logwood makes the strongest and quickest of all fences, and agrees with every soil: the cuttings make excellent oven-fuel.

So much for the general operations of plantership, according to the approved directions of Mr Martin. For the particular cultivation of the sugar-canes, the extraction of the sugar, and the distillation of rum, see the articles SUGAR and RUM.

PLANTING, in *Agriculture* and *Gardening*, is setting a tree or plant, taken from its proper place, in a new hole or pit; throwing fresh earth over its root, and filling up the hole to the level of the surface of the ground.

The first thing in planting is to prepare the ground before the trees or plants are taken out of the earth, that they may remain out of the ground as short a time as possible; and the next is, to take up the trees or plants, in order to their being transplanted. In taking up the trees, carefully dig away the earth round the roots, so as to come at their several parts to cut them off; for if they are torn out of the ground without care, the roots will be broken and bruised, to the great injury of the trees. When you have taken them up, the next thing is to prepare them for planting by pruning the roots and heads. And first, as to the roots; all the small fibres are to be cut off, as near to the place from whence they are produced as may be, except they are to be replanted immediately after they are taken up. Then prune off all the bruised or broken roots, all such as are irregular and cross each other, and all downright roots, especially in fruit-trees: shorten the larger roots in proportion to the age, the strength, and nature of the tree; observing that the walnut, mulberry, and some other tender-rooted kinds should not be pruned so close as the more hardy sorts of fruit and forest trees: in young fruit-trees, such as pears, apples, plums, peaches, &c. that are one year old from the time of their budding or grafting, the roots may be left only about eight or nine inches long; but in older trees, they must be left of a much greater length; but this is only to be understood of the larger roots; for the small ones must be chiefly cut quite out, or pruned very short. The next thing is the pruning of their heads, which must be differently performed in different trees; and the design of the trees must also be considered. Thus, if they are designed for walls or espaliers, it is best to plant them with the greatest part of their heads, which should remain on till they begin to shoot in the spring, when they must be cut down to five or six eyes, at the same time taking care not to disturb the roots. But if the trees are designed for standards, you should prune off all the small branches close to the place where they are produced, as also the irregular ones which cross each other; and after having displaced these branches, you should also cut off all such parts of branches as have by any accident been broken or wounded; but by no means cut off the main leading shoots which are necessary to attract the sap from the root, and thereby promote the growth of the tree. Having thus prepared the trees for planting, you must now proceed to place them in the earth: but first, if the trees have been long out of the ground, so that the fibres of the roots are dried, place them eight or ten hours in water, before they are planted, with their heads erect, and the roots only immersed therein; which

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for that, by long duration, will convert the finest mould into stiff clay. The proprietor of such a soil must therefore grudge no labour to drain it well; and yet by such easy gradation as to prevent the mould from being washed away by great floods in case the under stratum be a loam.

which will swell the dried vessels of the roots, and prepare them to imbibe nourishment from the earth. In planting them, great regard should be had to the nature of the soil; for if that be cold and moist, the trees should be planted very shallow; and if it be a hard rock or gravel, it will be better to raise a hill of earth where each tree is to be planted, than to dig into the rock or gravel, and fill it up with earth, as is too often practised, by which means the trees are planted as it were in a tub, and have but little room to extend their roots. The next thing to be observed is, to place the trees in the hole in such a manner that the roots may be about the same depth in the ground as before they were taken up; then break the earth fine with a spade, and scatter it into the hole, so that it may fall in between every root, that there may be no hollowness in the earth: then having filled up the hole, gently tread down the earth with your feet, but do not make it too hard; which is a great fault, especially if the ground be strong or wet. Having thus planted the trees, they should be fastened to stakes driven into the ground to prevent their being displaced by the wind, and some mulch laid upon the surface of the ground about their roots; as to such as are planted against walls, their roots should be placed about five or six inches from the wall, to which their heads should be nailed to prevent their being blown up by the wind. The seasons for planting are various, according to the different sorts of trees, or the soil in which they are planted. For the trees whose leaves fall off in winter, the best time is the beginning of October, provided the soil be dry; but if it be a very wet soil, it is better to defer it till the latter end of February, or the beginning of March: and for many kinds of evergreens, the beginning of April is by far the best season; though they may be safely removed at midsummer, provided they are not to be carried very far; but should always make choice of a cloudy wet season.

In the second volume of the papers, &c. of the Bath Society there is a letter on planting waste grounds. The gentleman who writes it informs us, that in the county of Norfolk, where he resides, there were about 60 or 70 years ago vast tracts of uncultivated ground, which were then thought totally barren. "The western parts of it (says he) abounded with sand of so light a texture, that they were carried about by every wind; and in many places the sands were so loose that no grass could grow upon them. Art and industry, however, have now so altered the face of this once Arabian desert, that it wears a very different appearance. Most of these tracts are either planted or rendered very good corn-land and sheep-walks.

"About 30 years since, the sides of many of our little sand-hills were sown with the seeds of French furze, and when a wet season followed, they succeeded very well, and grew so fast, that once in three or four years they are cut for fuel, and sell at a good price at Thetford, Brandon, Harling, Swaffham, and places adjacent. This excited some public-spirited gentlemen, among whom was the late Mr Buxton of Shadwell-Lodge, near Thetford, to attempt the planting of Scotch and spruce firs, and other hardy forest-trees. At first they found some difficulty from the extreme looseness of the sand. But as there is in all this part of the country fine white and yellow marle, at about three feet depth below the sand, they very judiciously thought that incorporating it with the sand in the holes where their young trees were planted, would insure success; nor were they disappointed. The method succeeded beyond expectation; the plantations throve exceedingly, and the roots soon reached below the sand, after which they were out of danger. This excited them to further attempts.

"On the spots where they intended to raise new plantations from seeds and acorns, they laid on a thick coat of marle and clay, which after being rough spread, and lying a winter in that state, was made fine, and ploughed in just before planting. By these means the soil became fixed, and in a little time covered with grass and herbage; so that there are now vast plantations of firs, oak, and forest-trees, in the most healthy and vigorous state, where within my memory ten acres of land would not maintain a single sheep three months.

"But the benefit of plantations, whether of shrubs, copse, or trees, is not confined to the immediate advantage, or even the future value of the wood. By annually shedding a great number of leaves, which the winds disperse, and the rains wash into the soil, it is considerably improved; and whenever such copses have been stubbed up, the ground (however unfruitful before planting) has thereby been so enriched as to bear excellent crops for many years, without the additional help of manure. How much land-owners are interested in planting waste or barren spots I need not mention; and nothing but a degree of indolence or ignorance unpardonable in this enlightened age could induce them to neglect it.

"Nature has furnished us with plants, trees, and shrubs, adapted to almost every soil and situation; and as the laws of vegetation are now much better understood than formerly, it is a reproach to those whose practise does not keep pace with their knowledge in making the best use of her bounty. Let no man repine and say *the land is barren;* for those spots which appear to be so, owe that appearance to human negligence. Industry and art might soon render an eighth part of this kingdom nearly as valuable as the rest, which now remains in a state unprofitable to the owners, and disgraceful to the community."

Reverse PLANTING, a method of planting in which the natural position of the plant or shoot is inverted; the branches being set into the earth, and the root reared into the air. Dr Agricola mentions this monstrous method of planting, which he found to succeed very well in most of all sorts of fruit-trees, timber-trees, &c. Bradley affirms, that he has seen a lime-tree in Holland growing with its first roots in the air, which had shot out branches in great plenty, at the same time that its first branches produced roots and fed the tree. Mr Fairchild of Hoxton has practised the same with us, and gives the following directions for performing it: Make choice of a young tree of one shoot, of alder, elm, willow, or any other tree that easily takes root by laying; bend the shoot gently down into the earth, and so let it remain until it has taken root. Then dig about the first root, and raise it gently out of the ground, till the stem be nearly upright, and stake it up. Then prune the roots, now erected in the air, from the bruises and wounds they received in being dug up; and anoint the pruned parts with a composition of two ounces of turpentine, four ounces of tallow, and four ounces of bees wax, melted together, and applied pretty warm. Afterwards prune off all the buds or shoots that are upon the stem, and dress the wounds with the same composition, to prevent any collateral shootings, that might spoil the beauty of the stem.

PLANUDES, Maximus, a Greek monk of Constantinople, towards the end of the 14th century, who published a collection of epigrams intitled *Anthologia;* a Greek translation of Ovid's Metamorphoses; a Life of Æsop, which is rather a romance than a history; and some other works. We know nothing more of him, than that he suffered some persecution on account of his attachment to the Latin church.

PLASHING *of* Hedges, is an operation thought by some persons to promote the growth and continuance of old hedges; but whether the fact be so or not will admit of some dispute. See Hedges.

It is performed in this manner: The old stubs must be cut off, &c. within two or three inches of the ground; and the best and longest of the middle-sized shoots must be left to lay down. Some of the strongest of these must also be left to answer the purpose of stakes. These are to be cut off to the height at which the hedge is intended to be left; and they are to stand at ten feet distance one from another: when there are not proper shoots for these at the due distances, their places must be supplied with common stakes of dead wood. The hedge is to be first thinned, by cutting away all but those shoots which are intended to be used either as stakes, or the other work of the plashing: the ditch is to be cleaned out with the spade; and it must be now dug as at first, with sloping sides each way; and when there is any cavity on the bank on which the hedge grows, or the earth has been washed away from the roots of the shrubs, it is to be made good by facing it, as they express it, with the mould dug from the upper part of the ditch: all the rest of the earth dug out of the ditch is to be laid upon the top of the bank: and the owner should look carefully into it that this be done; for the workmen, to spare themselves trouble, are apt to throw as much as they can upon the face of the bank; which being by this means overloaded, is soon washed off into the ditch again, and a very great part of the work undone; whereas what is laid on the top of the bank always remains there, and makes a good fence of an indifferent hedge.

In the plashing the quick, two extremes are to be avoided; these are the laying it too low, and the laying it too thick. The latter makes the sap run all into the shoots, and leaves the plashes without sufficient nourishment; which, with the thickness of the hedge, finally kills them. The other extreme of laying them too high, is equally to be avoided; for this carries up all the nourishment into the plashes, and so makes the shoots small and weak at the bottom, and consequently the hedge thin. This is a common error in the north of England. The best hedges made anywhere in England are those in Hertfordshire; for they are plashed in a middle way between the two extremes, and the cattle are by that prevented both from cropping the young shoots, and from going through; and a new and vigorous hedge soon forms itself.

When the shoot is bent down that is intended to be plashed, it must be cut half way through with the bill: the cut must be given sloping, somewhat downwards, and then it is to be wound about the stakes, and after this its superfluous branches are to be cut off as they stand out at the sides of the hedge. If for the first year or two, the field where a new hedge is made can be ploughed, it will thrive the better for it; but if the stubs are very old, it is best to cut them quite down, and to secure them with good dead hedges on both sides, till the shoots are grown up from them strong enough to plash; and wherever void spaces are seen, new sets are to be planted to fill them up. A new hedge raised from sets in the common way, generally requires plashing in about eight or nine years after.

PLASSEY, is a grove near the city of Muxadab in India, famous for a battle fought between the English under Lord Clive, and the native Hindoos under the nabob Surajah Dowlah. The British army consisted of about 3200 men, of whom the Europeans did not exceed 900; while that of the nabob consisted of 50,000 foot, and 18,000 horse. Notwithstanding this great disproportion, however, Lord Clive effectually routed the nabob and his forces, with the loss of three Europeans and 26 Seapoys killed, and five Europeans and 40 Seapoys wounded. The nabob's loss was estimated at about 200 men, besides oxen and elephants. See Clive.

PLASTER, or Emplaster, in *Pharmacy*, an external application of a harder consistence than an ointment; to be spread according to the different circumstances of the wound, place, or patient, either upon linen or leather.

Plaster, or *Plaister*, in building, a composition of lime, sometimes with sand, &c. to parget, or cover the nudities of a building. See Pargeting and Stucco.

Plaster of Paris, a preparation of several species of gypsum dug near Mount Martre, a village in the neighbourhood of Paris; whence the name. See Alabaster, Gypsum, and Sulphate of Lime, under Chemistry.

The best sort is hard, white, shining, and marbly; known by the name of *plaster-stone* or *parget of Mount Martre*. It will neither give fire with steel, nor ferment with aquafortis; but very freely and readily calcines in the fire into a fine plaster, the use of which in building and casting statues is well known.

The method of representing a face truly in plaster of Paris is this: The person, whose figure is designed, is laid on his back, with any convenient thing to keep off the hair. Into each nostril is conveyed a conical piece of stiff paper, open at both ends, to allow of respiration. These tubes being anointed with oil, are supported by the hand of an assistant; then the face is lightly oiled over, and the eyes being kept shut, alabaster fresh calcined, and tempered to a thinnish consistence with water, is by spoonfuls nimbly thrown all over the face, till it lies near the thickness of an inch. This matter grows sensibly hot, and in about a quarter of an hour hardens into a kind of stony concretion; which being gently taken off, represents, on its concave surface, the minutest part of the original face. In this a head of good clay may be moulded; and therein the eyes are to be opened, and other necessary amendments made. This second face being anointed with oil, a second mould of calcined alabaster is made, consisting of two parts joined lengthwise.

Plaster.

lengthwise along the ridge of the nose; and herein may be cast, with the same matter, a face extremely like the original.

If finely powdered alabaster, or plaster of Paris, be put into a bason over a fire, it will, when hot, assume the appearance of a fluid, by rolling in waves, yielding to the touch, steaming, &c. all which properties it again loses on the departure of the heat; and being thrown upon paper, will not at all wet it, but immediately discover itself to be as motionless as before it was set over the fire; whereby it appears, that a heap of such little bodies, as are neither spherical nor otherwise regularly shaped, nor small enough to be below the discernment of the eye, may, without fusion, be made fluid, barely by a sufficiently strong and various agitation of the particles which compose it; and moreover lose its fluidity immediately upon the cessation thereof.

Two or three spoonfuls of burnt alabaster, mixed up thin with water, in a short time coagulate, at the bottom of a vessel full of water, into a hard lump, notwithstanding the water that surrounded it. Artificers observe, that the coagulating property of burnt alabaster will be very much impaired or lost, if the powder be kept too long, especially if in the open air, before it is made use of; and when it hath been once tempered with water, and suffered to grow hard, they cannot, by any burning or powdering of it again, make it serviceable for their purpose as before.

This matter, when wrought into vessels, &c. is still of so loose and spongy a texture, that the air has easy passage through it. Mr Boyle gives an account, among his experiments with the air-pump, of his preparing a tube of this plaster, closed at one end and open at the other; and on applying the open end to the cement, as is usually done with the receivers, it was found utterly impossible to exhaust all the air out of it; for fresh air from without pressed in as fast as the other, or internal air, was exhausted, though the sides of the tube were of a considerable thickness. A tube of iron was then put on the engine; so that being filled with water, the tube of plaster of Paris was covered with it; and on using the pump, it was immediately seen, that the water passed through into it as easily as the air had done, when that was the ambient fluid. After this, trying it with Venice turpentine instead of water, the thing succeeded very well; and the tube might be perfectly exhausted, and would remain in that state several hours. After this, on pouring some hot oil upon the turpentine, the case was much altered; for the turpentine melting with this, that became a thinner fluid, and in this state capable of passing like water into the pores of the plaster. On taking away the tube after this, it was remarkable that the turpentine, which had pervaded and filled its pores, rendered it transparent, in the manner that water gives transparency to that singular stone called *oculus mundi*. In this manner, the weight of air, under proper management, will be capable of making several sorts of glues penetrate plaster of Paris; and not only this, but baked earth, wood, and all other bodies, porous enough to admit water on this occasion.

Plaster of Paris is used as a manure in Pennsylvania, as we find mentioned in a letter from a gentleman in that country inserted in the 5th volume of the Bath Society Papers, and which we shall insert here for the satisfaction and information of our agricultural readers. "The best kind is imported from hills in the vicinity of Paris: it is brought down to the Seine, and exported from Havre de Grace. I am informed there are large beds of it in the bay of Fundy, some of which I have seen nearly as good as that from France; nevertheless several cargoes brought from thence to Philadelphia have been used without effect. It is probable this was taken from the top of the ground, and by the influence of the sun and atmosphere dispossessed of the qualities necessary for the purposes of vegetation. The lumps composed of flat shining specula are perferred to those which are formed of round particles like sand: the simple method of finding out the quality is to pulverize some, and put it dry into an iron pot over the fire, when that which is good will soon boil, and great quantities of the fixed air escape by ebullition. It is pulverized by first putting it in a stamping-mill. The finer its pulverization the better, as it will thereby be more generally diffused.

"It is best to sow it in a wet day. The most approved quantity for grass is six bushels per acre. No art is required in sowing it more than making the distribution as equal as possible on the sward of grass. It operates altogether as a top manure, and therefore should not be put on in the spring until the principal frosts are over and vegetation hath begun. The general time for sowing with us is in April, May, June, July, August, and even as late as September. Its effects will generally appear in 10 or 15 days; after which the growth of the grass will be so great as to produce a large burden at the end of six weeks after sowing.

"It must be sown on dry land, not subject to be overflown. I have sown it on sand, loam, and clay, and it is difficult to say on which it has best answered, although the effect is sooner visible on sand. It has been used as a manure in this state for upwards of 12 years. Its duration may, from the best information I can collect, be estimated from 7 to 12 years; for, like other manure, its continuance very much depends on the nature of the soil on which it is placed.

"One of my neighbours sowed some of his grass ground six years ago, another four years ago; a great part of my own farm was sown in May 1788. We regularly mow two crops, and pasture in autumn; no appearance of failure, the present crop being full as good as any preceding. I have this season mowed 50 acres of red clover, timothy grass, white clover, &c. which was plastered last May, July, and September: many who saw the grass estimated the produce at two tons per acre, but I calculate the two crops at three tons. Several stripes were left in the different fields without plaster; these were in a measure unproductive, being scarcely worth mowing. In April 1788, I covered a piece of grass land upwards of two inches thick with barn manure; in the same worn-out field I sowed plaster, to contrast it with the dung. I mowed the dunged and plastered land twice last year and once this; in every crop the plaster has produced the most. You will remember, in all experiments with clover, to mix about one-third timothy grass seed; it is of great advantage in serving as a support for the clover; it very much facilitates the curing of clover, and when cured is a superior fodder. The plaster operates equally as well on the other grasses as on clover. Its effect is said to be good on wheat, if sown in the spring; but I cannot say this from experience. On Indian corn I know its operation to be great; we use it at the rate of a table spoonful for a hill, put in immediately after dressing.

"From some accurate experiments last year made and reported to our Agricultural Society, it appears that nine bushels of additional corn per acre were produced by this method of using plaster."

PLASTERING. See Pargetting.

PLASTIC, denotes a thing endowed with a formative power, or a faculty of forming or fashioning a mass of matter after the likeness of a living being.

Plastic Nature, a certain power, by which, as an instrument, many philosophers, both ancient and modern, have supposed the great motions in the corporeal world, and the various processes of generation and corruption, to be perpetually carried on.

Among the philosophers of Greece, such a power was almost universally admitted. It seems, indeed, to have been rejected only by the followers of Democritus and Epicurus, who talk as if they had thought gravity essential to matter, and the *fortuitous* motion of atoms, which they held to have been from eternity, the source not only of all the *regular* motions in the universe, but also of the *organization* of all corporeal systems, and even of *sensation* and *intellection*, in brutes and in men. It is needless to say, that those men, whatever they might profess, were in reality atheists; and Democritus, it is universally known, avowed his atheism.

The greater part of the philosophers who held the existence of a plastic nature, considered it not as an *agent* in the strict sense of the word, but merely as an instrument in the hand of the Deity; though even among them there were some who held no superior power, and were of course as gross atheists as Democritus himself. Such was *Strato* of Lampsacus. This man was originally of the peripatetic school, over which he presided many years, with no small degree of reputation for learning and eloquence. He was the first and chief assertor of what has been termed *Hylozoic atheism;* a system which admits of no power superior to a certain *natural* or *plastic life*, *essential*, *ingenerable*, and *incorruptible*, inherent in manner, but without sense and consciousness. That such was his doctrine we learn from Cicero, who makes *Velleius* the Epicurean say, "Nec audiendus *Strato* qui *Physicus* appellatur, qui omnem vim divinam in Natura sitam esse censet, quæ causas gignendi, augendi, minuendive habeat, sed careat omni sensu [*]." That Strato in admitting this plastic principle, differed widely from Democritus, is apparent from the following account of him by the same author: *Strato Lampsacenus* negat opera deorum se uti ad fabricandum mundum, quæcunque sint docet omnia esse effecta *naturæ*, nec ut ille, qui asperis, et levibus, et hamatis uncinatisque corporibus concreta hæc esse dicat, interjecta inani; somnia censet hæc esse *Democriti*, non docentis sed optantis [†]."

That the rough and smooth, and hooked and crooked, atoms of Democritus, were indeed dreams and dotages, is a position which no man will controvert; but surely Strato was himself as great a dreamer when he made sensation and intelligence result from a certain plastic or spermatic life in matter, which is itself devoid of sense and consciousness. It is, indeed, inconceivable, to use the emphatic language of Cudworth, "how any one in his senses should admit such a monstrous paradox as this, that every atom of dust has in itself as much wisdom as the greatest politician and most profound philosopher, and yet is neither conscious nor intelligent!" It is to be observed of Strato likewise, that though he attributed a certain kind of life to matter, he by no means allowed of one common life as ruling over the whole material universe. He supposed the several parts of matter to have so many several plastic lives of their own, and seems [‡] to have attributed something to chance in the production and preservation of the mundane system.

In denying the existence of a God, perpetually directing his plastic principle, and in supposing as many of these principles as there are atoms of matter, Strato deviated far from the doctrine of Aristotle. The great founder of the peripatetic school, as well as his apostate disciple, taught that mundane things are not effected by fortuitous mechanism, but by such a *nature* as acts regularly and artificially for *ends;* yet he never considers this *nature* as the highest principle, or supreme *Numen*, but as subordinate to a perfect mind or intellect; and he expressly affirms, that "*mind* together with *nature*, formed or fashioned this universe." He evidently considers mind as the principal and intelligent agent, and nature as the subservient and executive instrument. Indeed, we are strongly inclined to adopt the opinion of the learned Mosheim, who thinks that by nature Aristotle meant nothing more than that *θερμοτης ψυχικη*, or *animal heat*, to which he attributes immortality, and of which he expressly says [§] that all things are full. Be this as it may, he always joins God and nature together, and affirms that they do nothing in vain. The same doctrine was taught before him by Plato, who affirms that "nature, together with reason, and according to it, orders all things." It must not, however, be concealed, that Plato seems to have attributed intelligence to the principle by which he supposed the world to be animated; for Chalcidius, commenting on the Timæus [‡], thus expresses himself: Hæc est illa *rationabilis* anima mundi, quæ gemina juxta meliorem naturam veneratione tutelam præbet inferioribus, divinis dispositionibus obsequens, providentiam nativis impertiens, æternorum similitudine propter cognationem beata."—Apuleius too, tells us [||], "Illam cœlestem animam, fontem animarum omnium, optimam virtutem esse genetricem, subserviri etiam Fabricatori Deo, et præsto esse ad omnia inventa ejus." *Plato pronunciat.*

The doctrine of Plato has been adopted by many moderns of great eminence both for genius and for learning. The celebrated Berkeley bishop of Cloyne, after giving the view of Plato's *anima mundi*, which the reader will find in our article Motion, N° 10, thus recommends the study of his philosophy [*]: "If that philosopher himself was not read only, but studied also with care, and made his own interpreter, I believe the prejudice that now lies against him would soon wear off, or be even converted into high esteem, for those exalted notions, and fine hints, that sparkle and shine throughout his writings; which seem to contain not only the most valuable learning of Athens and Greece, but also a treasure of the most remote traditions and early science of the east." Cudworth, and the learned author of *Ancient Metaphysics*, are likewise strenuous advocates for the Aristotelian doctrine of a plastic nature diffused through the material world; (see Metaphysics, N° 200, 201, 202.): and a notion very similar has lately occurred

[*] *Natu- corum*, cap.

[†] d. lib. p. 38.

[‡] *Cud. Int. Syst. ed. Mosheim*, lib i. cap. 3.

[§] *De Generatione Animal.* lib. iii. cap. 11,

[‡] Sect. 53.

[||] *De Dogmate Platonis.*

[*] *Siris*, N° 338.

occurred to a writer who does not appear to have borrowed it either from the *Lyceum* or the *Academy*.

This writer is Mr Young, of whose *active substance*, and its agency in moving bodies, some account has been given elsewhere, (see Motion). As a mere unconscious agent, *immaterial*, and, as he expresses himself, *immental*, it bears a striking resemblance to the *plastic nature* or *vegetable life* of Cudworth: but the author holds it to be not only the principle of motion, but also the *basis* or *substratum* of matter itself; in the production of which, by certain motions, it may be said to be more strictly *plastic* than the *hylarchical* principle, or *vis genitrix*, of any other philosopher with whose writings we have any acquaintance. Though this opinion be singular, yet as its author is evidently a man who thinks for himself, unawed by the authority of celebrated names, and as one great part of the utility of such works as ours consists in their serving as indexes to science and literature, we shall lay before our readers a short abstract of the reasonings by which Mr Young endeavours to support his hypothesis, and we shall take the liberty of remarking upon those reasonings as we proceed.

The author, after a short introduction, enters upon his work ‡, in a chapter intitled, *Analysis of Matter in general*. In that chapter there is little novelty. He treats, as others have done, of primary and secondary qualities, and adheres too closely to the language of Locke, when he says, that "the nature of bodies signifies the aggregate of all those *ideas* with which they furnish us, and by which they are made known." To say the best of it, this sentence is inaccurately expressed. An aggregate of *ideas* may be occasioned by the impulse of bodies on the organs of sense, but the effect of impulse cannot be that which impels. We should not have made this remark, which may perhaps be deemed captious, were we not persuaded that the vague and inaccurate use of terms is the source of those mistakes into which, we cannot help thinking, that the very ingenious author has sometimes fallen. Having justly observed, that we know nothing directly of bodies but their qualities, he proceeds to investigate the nature of solidity.

"Solidity (he says) is the quality of body which principally requires our notice. It is that which fills extension, and which resists other solids, occupying the place which it occupies; thus making extension and figure real, and different from mere space and vacuity. If the secondary qualities of bodies, or their powers variously to affect our senses, depend on their primary qualities, it is chiefly on this of solidity; which is therefore the most important of the primary qualities, and that in which the essence of body is by some conceived to consist. This idea of solidity has been judged to be incapable of any analysis; but it appears evident to me (continues our author), that the idea of solidity may be resolved into another idea, which is that of the power of resisting within the extension of body. Hence it becomes unnecessary, and even inadmissible, to suppose that solidity in the body is at all a pattern or archetype of our sensation."

That solidity in the body, and we know nothing of solidity any where else, is no pattern of any sensation of ours, is indeed most true, as we have shown at large in another place, (see Metaphysics, N° 44 and 171): but to reconcile this with what our author asserts immediately afterwards, that "solidity is no more in bodies than colours and flavours are, and that it is equally with them a *sensation* and an *idea*," would be a task to which our ingenuity is by no means equal. He affirms, indeed, that solidity, as it is said to be in bodies, is utterly incomprehensible; that we can perfectly comprehend it as a sensation in ourselves, but that in bodies nothing more is required than a power of active resistance to make upon our senses those impressions from which we infer the reality of primary and secondary qualities. This power of resistance, whether it ought to be called active or passive, we apprehend to be that which all other philosophers have meant by the word *solidity*; and though Locke, who uses the words *idea* and *notion* indiscriminately, often talks of the *idea* of solidity, we believe our author to be the first of human beings who has thought of treating *solidity* as a sensation in the mind.

Though it is wrong to innovate in language, when writing on subjects which require much attention, we must, however, acknowledge it to be unworthy of inquirers after truth to dispute about the proper or improper use of terms, so long as the meaning of him who employs them can be easily discovered. We shall, therefore, follow our author in his endeavours to ascertain what this power of resistance is which is commonly known by the name of solidity. All power he justly holds to be active; and having, by an argument (A) of which

‡ *An Essay on the powers and mechanism of nature.*

"(A) We can only conceive of solidity as being a resistance of the *parts* of any body, to a power which endeavours to *separate* them, or to bring them *nearer* together. Now that which resists any power, and prevents its effect, is also a power. By resistance, I mean here an active resistance, such as an animal can employ against an animal. If a horse pulls against a load, he draws it along; but if he draws against another horse, he is put to a stand, and his endeavour is defeated. When any endeavour to change the situation of the parts of any solid is in like manner prevented from taking effect, and the parts retain their situation, the situation has plainly been preserved by an active resistance or power, equivalent to that which was fruitlessly exerted on them."

Such is our author's reasoning to prove that matter is essentially active, and that from this activity results our notion of its solidity: but does he not here confound solidity with hardness, and impenetrability with cohesion? He certainly does; for *water* is as *solid*, in the proper sense of the word, as *adamant*, and the particles of *air* as the particles of *iron*. The parts of water are, indeed, separated with ease, and those of adamant with difficulty; but it is not because the latter have more solidity than the former, but because the power of cohesion, whatever it may be, operates upon them with greater force. Solidity is an attribute of a whole; hardness and softness result from the cohesion of parts. We do not at all perceive the propriety of the simile of the horse pulling a load, and afterwards pulling against another horse. Is it because both horses are *active* that one of them cannot prevail against the other, and because the load is *inactive* that either of them may drag along a mass of iron of half a ton weight?

If

which we do not perceive the force, attempted to prove that it is by an inward *power*, and not by its *inertia*, that one body prevents another from occupying the same place with itself, he naturally enough infers matter to be essentially active. "But the activity of matter is to be considered in a certain limited sense, and its inertness is to be regarded in another limited sense; so that these are compatible within their respective limits. The activity of body may be considered as belonging to the parts of a compound; its inertia as the inertia formed of those parts. The actions of the parts are everywhere opposed to each other, and equal; and hence results the inactivity of the whole."

SOLIDITY alone of the primary qualities being positive, and peculiar to bodies, and our author having resolved this into ACTION or POWER, it follows, by his analysis, that the ESSENCE OF BODY is reduced to power likewise. But, as he properly observes, power is an idea of reflection, not acquired by the senses, but suggested by thought. Hence our knowledge of real existence in body must be such as is suggested to us by our thoughts exercised about our sensations. "We are capable of acting and producing changes in appearances; and this faculty, which we experience to exist in ourselves, we call power. We are conscious of the exertion of our own power; and, therefore, when we see ACTION or CHANGE happen without any exertion of ours, we refer this to other powers without us, and necessarily conclude the POWER to exist where the change begins or the action is exerted. This power, then, referred to bodies, must exist in them, or it can exist no where."

In two chapters, which might easily have been compressed into one not so long as the shortest of them, our author analyzes *atoms* or the primary particles of matter, and strenuously opposes their impenetrability. He allows that there are atoms of matter not divisible by any known force; but as these, however small, must still be conceived as having extension, each of them must be composed of parts held together by the same power which binds together many atoms in the same body. This power, indeed, he acknowledges to operate much more forcibly when it cements the parts of a primary atom than when it makes many atoms cohere in one mass; but still it operates in the same manner: and as the ideal analysis may be carried on *ad infinitum*, the only positive idea which is suggested by atoms, or the parts of atoms, is the idea of a resisting power. That this power of resistance, which constitutes what is vulgarly called the solidity of bodies, may not be absolutely impenetrable, he attempts to prove, by showing that resistance does in fact take place in cases where impenetrability, and even solidity, are not supposed by any man.

"Let us endeavour (says he) to bring together two like poles of a magnet, and we shall experience a resistance to their approximation. Why, then, may not a piece of iron, which between our fingers resists their coming together, resist by an efficacy perfectly similar, though more strongly exerted? If magnetism were to act upon our bodies as upon iron, we should feel it; or were magnets endowed with sensation, they would feel that which resists their nearer approach. The resisting extension between the two magnets is permeable to all the rays of light, and reflecting none is therefore unseen; but it is easy to conceive that the same power which resists the approach of the iron might resist and reflect some rays of light. We should then have a visible object interposed between the two magnets, as we have before supposed it might be a tangible one. It is likewise easy to conceive that which is tangible and visible so applied to our organs of tasting, of smelling, and of hearing, as to excite ideas of flavours, odours, and sounds. Thus we see that an action, in which no supposition of solidity or impenetrability is involved, may be conceived to assume all the qualities of matter, by only supposing a familiar effect extended in its operation."

This reasoning is exceedingly ingenious, though perhaps not original; but what is of more importance, it does not approach so near to demonstration as the author seems to imagine. If magnets operate by means of a fluid issuing from them (see MAGNETISM), those who hold the solidity or impenetrability of matter will maintain, that each atom of the magnetic fluid is solid and impenetrable. That we do not see nor feel these atoms, will be considered as no argument that they do not exist; for we do not see, nor in a close room feel, the atoms of the surrounding atmosphere; which yet Mr Young will acknowledge to have a real existence, and to be capable of operating upon our senses of hearing and smelling. Let us, however, suppose, that by this reasoning he has established the non-existence of every thing in the primary atoms of matter but active powers of resistance, and let us see how he conceives the actions of these powers to constitute what gives us the notion of inert and solid body; for that we have such a notion cannot be denied.

To ACT he allows to be an attribute, and justly observes, that we cannot conceive an attribute to exist without a substance. "But (says he) we have traced all phenomena to action as to a generic idea, comprehending under it all forms of matter and motion as species of that genus. By this analysis, that complex idea we have usually denominated matter, and considered as the substance or substratum to which motion appertained as an attribute, is found to change its character, and to be itself an attribute of a substance essentially active, of which one modification of motion produces matter and another generates motion." The action of this substance Mr Young determines to be motion, (see MOTION, N° 16.); and he proceeds to inquire by what kind of motion it produces matter, or inert and resisting atoms.

"Whatever portion of the ACTIVE SUBSTANCE is given to form an atom, the following things are necessary to be united in such portion of active substance: 1*st*, It must in some respect continually move; for otherwise it would lose its nature, and cease to be active. 2*dly*, It must also in some other respect be at rest, for otherwise it could not form an inactive atom. 3*dly*, It must preserve unity within itself." The author's

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If so, double or triple the mass, and a very strange phenomenon will be the result; for we shall have an active whole compounded of two or three inactive parts, even though those parts should not be in contact!

proof of the first of these positions we have given elsewhere. The second he holds to be self-evident; and the third he thinks established by the following reasoning: "Solidity is the result of those actions among the parts of any whole, whereby the unity of the whole is preserved within itself. Several uncohering things may be united by an external bond: this does not constitute these one solid; it may be one bundle; but if several things cohere, and have an unity preserved within themselves, they become one solid. An atom is the least and most simple solid."

Having thus proved the necessity of these three requisites to the formation of an atom, he observes, that "the two first can only be united in a rotation of the portion of active substance about a centre or axis at rest. By such a motion, *all the parts* successively occupy *different places* in the orbit of rotation, and therefore move; the centre round which they revolve being at rest, the *whole portion* is also at rest; and thus the portion is at once moving and quiescent, as is required. The same kind of motion will also fulfil the terms of the third requisite; for a substance having a revolving motion around its own centre, preserves its unity by reason of all the parts preserving the same relation to the centre: and further, a motion of the active substance about a centre or axis will be an activity in the same orbit, which will act upon and resist whatever shall interfere to oppose its activity, or destroy the unity of the sphere, by diverting the course of the revolving motions. The activity or motion of a portion of ACTIVE SUBSTANCE about a centre will, therefore, give solidity to such portion; for it will give it unity and resistance, and in a manner tie together all the parts, forming them into one mass about their common centre: for they move or are active not *towards* the centre, in which case they would be lost in non-extension; nor *from* the centre, where they would dissipate in boundless space; but *about* the centre, preserving the same limits of extension: and being in this way active, they in this way resist any other activity opposed to them, that is, they resist any action which tends to penetrate or divide this sphere of revolving activity. Therefore, since any portion of active substance does, by revolving about a centre, become an united, resisting, and quiescent whole, the smallest portions of the ACTIVE SUBSTANCE which have such motions will become *atoms*, or make the smallest portions of matter."

Having thus shown to his own satisfaction how atoms of matter are formed, he next explains what at first he confesses may have appeared a paradox, "how the ACTIVE SUBSTANCE, retaining its own nature and essential properties, continuing immaterial, unsolid, and active, puts on at the same time the form of matter, and becomes material, solid, and inert. A sphere of revolving active substance, as it revolves continually about a centre, and as parts of the substance are considered as successively passing through every point in the orbit; considered thus in its parts, and in its motions, it is ACTIVE SUBSTANCE, immaterial, and unsolid; but the whole sphere, considered unitically, collectively, and as quiescent, is in this point of view a solid atom, material, and inert."

Such is the active substance of Mr Young, and such his theory of the formation of matter. That he has not with servility copied from the ancients, every reader of his book, who is not an absolute stranger to Greek and Roman literature, will readily acknowledge; and yet if his theory be well founded, he has discovered a middle substance between mind and matter, more properly *plastic* than Aristotle or Plato, Cudworth or Berkeley, ever conceived. But truth compels us to add, that to us his theory appears to labour under insuperable objections. That there *may* be in the universe a substance essentially active, and at the same time not intelligent, is a proposition which we are by no means inclined to controvert. Various phenomena, both in vegetable and animal life, lead us to suspect that there is such a substance; but it does not follow that we are inclined to adopt our author's doctrine respecting the formation of matter. He conceives his proof, indeed, to be "in its nature not at all imperfect, or to fall short of demonstration; and if any one refuse it, he thinks it will be necessary for him to show, either that the explanation offered is not sufficient, or that some other explanation will serve equally well."

To show that the explanation offered is not sufficient, will not, we apprehend, be a very arduous task; but we have no inclination to attempt ourselves another explanation, because we believe that of the formation of matter no other account can be given than that which resolves it into the *fiat* of the Creator. That it cannot be formed by the motion of an immaterial substance in the manner which our author has very clearly described, seems to be a truth so evident as not to admit of proof; for if motion be, as he defines it, a change of place, every thing that is moved must have the quality of extension. But all the parts of this active substance which are given to form an atom, move round a centre, and are expressly said to occupy successively different *places* in the orbit of rotation. Every one of these parts, therefore, is an extended being: and since, according to our author, solidity is nothing but an *active power of resistance*, and the parts of this active substance, in their rotation round their centre, *act upon* and *resist* whatever interferes to oppose their activity, it follows that each of these parts is likewise a *solid being*. But, in the opinion of Mr Young himself, and of all mankind, whatever is extended and solid is material. This theory, therefore, exhibits a process in which atoms are formed of a substance, which, though it is said to be *active*, *immaterial*, and unsolid, appears, when narrowly inspected, to be nothing else than a collection of those very atoms of which the author pretends to explain the formation. Mr Young, who examines and very freely censures some of the doctrines of Newton and others, is too much a man of science to be offended at us for stating objections to a theory which is quite new, to a transformation which he himself acknowledges may to many "appear not only problematical and difficult to conceive, but wholly impossible, and implying contradictions absolutely and for ever irreconcileable." Whether this be a just character of it our readers must determine; but if we did not believe the author to be a man of ingenuity, we should not have introduced him or his work to their acquaintance.

PLASTIC Art, the art of representing all sorts of figures by the means of moulds. This term is derived from the Greek word πλαστικη, which signifies the "art of forming, modelling, or casting, in a mould." A mould in general is a body that is made hollow for that purpose. The artist makes use of it to form figures in bronze, lead, gold, silver, or any other metal or fusible substance. The mould is made of clay, stucco, or other composition, and is hollowed into the form of the figure that is to be produced; they then apply the jet, which is a sort of funnel, through which the metal is poured that is to form the figures, and that is called *running the metal into the mould.*

It is in this manner, but with much practice and attention, that the artist forms, 1. Equestrian and pedestrian statues of every kind; 2. Groups; 3. Pedestals; 4. Bass-reliefs; 5. Medallions; 6. Cannons, mortars, and other pieces of artillery; 7. Ornaments of architecture, as capitals, bases, &c.; 8. Various sorts of furniture, as lustres, branches, &c. in every kind of metal: and in the same manner figures are cast in stucco, plaster, or any other fusible matter. See *Plaster of Paris.*

Wax being a substance that is very easily put in fusion, plastics make much use of it. There are impressions which are highly pleasing in coloured wax, of medallions, basso and alto relievos, and of detached figures; which, however, are somewhat brittle. But this matter has been carried too far: they have not only formed moulds to represent the likeness and the bust of a living person, by applying the plaster to the face itself, and afterwards casting melted wax into the mould; but they have also painted that waxen bust with the natural colours of the face, and have then applied glass eyes and natural hair; to which they have joined a stuffed body and limbs, with hands of wax; and have, lastly, dressed their figure in a real habit; and by these means have produced an object the most shocking and detestable that it is possible to conceive. It is not a statue, a bust, a natural resemblance that they form; but a dead body, a lifeless countenance, a mere carcase. The stiff air, the inflexible muscles, the haggard eyes of glass, all contribute to produce an object that is hideous and disgustful to every man of taste. Figures like these offend by affording too exact an imitation of nature. In no one of the polite arts ought imitation ever to approach so near the truth as to be taken for nature herself. Illusion must have its bounds; without which it becomes ridiculous.

There is another invention far more ingenious and pleasing, which is that wherein M. Lippart, antiquary and artist at Dresden, has so much excelled. He has found the means of resembling, by indefatigable labour, great expence, and infinite taste, that immense number of stones, engraved and in camaieu, which are to be seen in the most celebrated cabinets. He has made choice of those that are the most beautiful; and, with a paste of his own invention, he takes from these stones an impression that is surprisingly accurate, and which afterwards become as marble: these impressions he calls *pasti.* He then gives them a proper colour, and incloses each with a gold rim; and by ranging them in a judicious order, forms of them an admirable system. They are fixed on pasteboards, which form so many drawers, and are then enclosed in cases, which represent folio volumes, and have titles wrote on their backs; so that these fictitious books may conveniently occupy a place in a library. Nothing can be more ingenious than this invention; and, by means of it, persons of moderate fortune are enabled to make a complete collection of all antiquity has left that is excellent of this kind; and the copies are very little inferior to the originals.

There is also another method of taking the impressions of camaieus, medals, and coins, which is as follows: They wash or properly clean the piece whose impression is to be taken, and surround it with a border of wax. They then dissolve isinglass in water, and make a decoction of it, mixing with it some vermilion, to give it an agreeable red colour. They pour this paste, when hot, on the stone or medal, to the thickness of about the tenth part of an inch; they then leave it exposed to the sun, in a place free from dust. After a few days this paste becomes hard, and offers to the eye the most admirable and faithful representation of the medal that it is possible to conceive: they are then carefully placed in drawers; and thousands of these impressions, which comprehend many ages, may be included in a small compass.

The proficients in plastics have likewise invented the art of casting in a mould papier maché or dissolved paper, and forming it into figures in imitation of sculpture, of ornaments and decorations for ceilings, furniture, &c. and which they afterwards paint or gild. There are, however, some inconveniencies attending this art; as, for example, the imperfections in the moulds, which render the contours of the figures inelegant, and give them a heavy air: these ornaments, moreover, are not so durable as those of bronze or wood, seeing that in a few years they are preyed on by the worm.

The figures that are given to porcelain, Delft ware, &c. belong also to plastics; for they are formed by moulds, as well as by the art of the sculptor and turner; and by all these arts united are made vases of every kind, figures, groups, and other designs, either for use or ornament.

From this general article the reader is referred to Foundery, Cast, Glazing, Porcelain, *Papier-Maché*, Pottery, *Delft Ware.*

PLATA, the name of a very great river of South America, running through the province of Paraguay: whence the whole country is sometimes called *Plata;* though this name is usually bestowed only upon a part of Paraguay. In the latter sense it comprehends all that country bounded on the east and south-east by the Atlantic ocean; on the south by Terra Magellanica; on the west by Tucuman; and on the north, by the provinces of Paraguay Proper and Parana. The great river La Plata, from which the country has its name, was first discovered, in 1515, by Juan Diaz de Solis; but denominated *La Plata* by Sebastian Gabato, from the great quantity of the precious metals he procured from the adjacent inhabitants, imagining it was the produce of the country, though in fact they brought it from Peru.

The country lies between 32° and 37° of south latitude. The climate is pleasant and healthy. Their winter is in May, June, and July, when the nights are indeed very cold, but the days moderately warm; the frost is neither violent nor lasting, and the snows are very inconsiderable.

The country consists mostly of plains of a vast extent, and exceeding rich soil, producing all sorts of European and American fruits, wheat, maize, cotton, sugar, honey, &c. and abounding with such excellent pastures, that the beasts brought thither from Spain are multiplied to such a degree, that they are all in common, no man claiming any property in them, but every man takes what he hath occasion for. The number of black cattle, especially, is so prodigious, that many thousands of them are killed merely for their hides, every time the ships go for Spain, and their carcases left to be devoured by wild beasts and birds of prey, which are also very numerous. Sometimes, when they cannot vend their hides, they will kill them for their tongues; and those who care not to be at the trouble to fetch them from the plains, may buy them for a trifle. There is a curious account in Lord Anson's voyage of the manner of hunting them on horseback; and of catching and killing them, by throwing a noose on their horns at full gallop, the horses being trained to the sport. Horses are no less numerous, and in common like the other cattle: so that a man may have as many as he pleases for the catching; and of those that are already broke, one may buy some of the best, and of the true Spanish breed, for a piece-of-eight per head. Wild-fowl also is in great plenty here; partridges in particular are more numerous, and as large and tame as our hens, so that one may kill them with a stick. Their wheat makes the finest and whitest of bread; and, in a word, they seem to want for nothing here, especially the natives, but salt and fuel. The former the Spaniards have brought to them from other parts; and the latter they supply themselves with, by planting vast numbers of almond, peach, and other trees, which require no other trouble than putting the kernels into the ground, and by the next year, we are told, they begin to bear fruit. The return for European commodities is so great here, that it almost exceeds belief; an ordinary two-penny knife fetching a crown, and a gun of the value of 10 or 12 shillings 20 or 30 crowns, and so of the rest.

The river Plata rises in Peru, and receives a great many others in its course; the chief of which is the Paraguay. The water of it is said to be very clear and sweet, and to petrify wood; and contains such plenty and variety of fish, that the people catch great quantities of them without any other instrument than their hands. It runs mostly to the south and south-east; and is navigable the greater part of its course by the largest vessels, and full of delightful islands. All along its banks are seen the most beautiful birds of all kinds; but it sometimes overflows the adjacent country to a great extent, and is infested by serpents of a prodigious bigness. From its junction with the Paraguay to its mouth it is above 200 leagues. We may form some judgment of its largeness by the width of its mouth, which is said to be about 70 leagues. Before it falls into the Paraguay it is called *Panama*. See PANAMA.

PLATÆÆ, in *Ancient Geography*, a very strong town of Bœotia, in its situation exposed to the north wind (Theophrastus); burnt to the ground by Xerxes (Herodotus, Justinus); mentioned much in the course of the Persian war: Famous for the defeat of Mardonius, the Persian general; and for the most signal victory of the Lacedæmonians and other Greeks under Pausanias the Lacedæmonian, and Aristides an Athenian general (Nepos, Diodorus, Plutarch); in memory of which the Greeks erected a temple to Jupiter Eleutherius, and instituted games which they called *Eleutheria;* and there they show the tombs of those who fell in that battle (Strabo). It stood at the foot of Mount Cithæron, between that and Thebes to the north, on the road to Athens and Megara, and on the confines of Attica and Megaris. Now in ruins.

PLATALEA, the SPOONBILL, a genus of birds belonging to the order of grallæ. See ORNITHOLOGY *Index*.

PLATANUS, the PLANE-TREE; a genus of plants belonging to the monœcia class. See BOTANY *Index*.

PLATBAND, in *Gardening*, a border or bed of flowers, along a wall, on the side of a parterre, frequently edged with box, &c.

PLATBAND of a door or window, is used for the lintel, where that is made square, or not much marked.

PLATE, a term which denotes a piece of wrought silver, such as the shallow vessel off which meat is eaten. It is likewise used by sportsmen to express the reward given to the best horse at our races.

Sportsman's Dictionary.

The winning a plate is not the work of a few days to the owner of the horse; but great care and preparation is to be made for it, if there is any great dependence on the success. A month is the least time that can be allowed to draw the horse's body clear, and to refine his wind to that degree of perfection that is attainable by art.

It is first necessary to take an exact view of his body, whether he be low or high in flesh; and it is also necessary to consider whether he be dull and heavy, or brisk and lively when abroad. If he appear dull and heavy, and there is reason to suppose it is owing to too hard riding, or, as the jockeys express it, to some grease that has been dissolved in hunting, and has not been removed by scouring, then the proper remedy is half an ounce of diapente given in a pint of good sack; this will at once remove the cause, and revive the creature's spirits. After this, for the first week of the month, he is to be fed with oats, bread, and split beans; giving him sometimes the one and sometimes the other as he likes best; and always leaving some in the locker, that he may feed at leisure when he is left alone. When the groom returns at the feeding time, whatever is left of this must be removed, and fresh given; by this means the creature will soon become high-spirited, wanton, and full of play. Every day he must be rode out an airing, and every other day it will be proper to give him a little more exercise; but not so much as to make him sweat too much. The beans and oats in this case are to be put into a bag, and beaten till the hulls are all off, and then winnowed clean; and the bread, instead of being chipped in the common way, is to have the crust clean cut off. If the horse be in good flesh and spirits when taken up for its month's preparation, the diapente must be omitted; and the chief business will be to give him good food, and so much exercise as will keep him in wind, without oversweating him or tiring his spirits. When he takes larger exercises afterwards, towards the end of the month, it will be proper to have some horses in the place to run against him. This will put him upon his mettle, and the beating them will give him spirits. This, however, is to be cautiously observed, that he has not a bloody heat given him for ten days or a fortnight before the plate is to be run for; and that the last heat that is given him the day before the race, must be in his clothes: this will make him run with greatly more vigour, when stripped for the race, and feeling the cold wind on every part.

In the second week, the horse should have the same food, and more exercise. In the last fortnight, he must have dried oats, that have been hulled by beating. After this they are to be wetted in a quantity of whites of eggs beaten up, and then laid out in the sun to dry; and when as dry as before, the horse is to have them. This sort of food is very light of digestion, and very good for the creature's wind. The beans in this time should be given more sparingly, and the bread should be made of three parts wheat and one part beans. If he should become costive under this course, he must then have some ale and whites of eggs beaten together; this will cool him, and keep his body moist.

In the last week the mash is to be omitted, and barley-water given him in its place, every day, till the day before the race: he should have his fill of hay; then he must have it given him more sparingly, that he may have time to digest it; and in the morning of the race day he must have a toast or two of white bread soaked in sack, and the same just before he is let out to the field. This is an excellent method, because the two extremes of fullness and fasting are at this time to be equally avoided: the one hurting his wind, and the other occasioning faintness that may make him lose. After he has had his food, the litter is to be shook up, and the stable kept quiet, that he may be disturbed by nothing till he is taken out to run.

PLATFORM, in the military art, an elevation of earth, on which cannon is placed to fire on the enemy; such are the mounts in the middle of curtains. On the ramparts there is always a platform, where the cannon are mounted. It is made by the heaping up of earth on the rampart, or by an arrangement of madriers, rising insensibly, for the cannon to roll on, either in a casemate or on attack in the outworks. All practitioners are agreed, that no shot can be depended on, unless the piece can be placed on a solid platform; for if the platform shakes with the first impulse of the powder, the piece must likewise shake, which will alter its direction, and render the shot uncertain.

PLATFORM, in *Architecture*, is a row of beams which support the timber-work of a roof, and lie on the top of a wall where the entablature ought to be raised.

This term is also used for a kind of terrace or broad smooth open walk at the top of a building, from whence a fair prospect may be taken of the adjacent country. Hence an edifice is said to be covered with a platform, when it is flat at top, and has no ridge. Most of the oriental buildings are thus covered, as were all those of the ancients.

PLATFORM, or *Orlop*, in a man of war, a place on the lower deck, abaft the main-mast, between it and the cockpit, and round about the main capstan, where provision is made for the wounded men in time of action.

PLATINA is a metallic substance, the name of which has an allusion to its colour. It is a diminutive of *plata*, and signifies "little silver." From its great specific gravity, and other resemblances which it has to gold, it has been called *or blanc*, or *white gold;* from its refractory nature, *diabolus metallorum;* from some doubts entertained of its character as a metal, *juan blanco*, *white jack*, *white rogue*, or *white mock metal.* It has also received the appellation of the *eighth metal:* and, probably from some district which affords it, has gotten the name of *platina del Pinto.* For an account of its properties, and for its natural history, see CHEMISTRY; MINERALOGY; and ORES, *Reduction of.*

PLATING is the art of covering baser metals with a thin plate of silver either for use or for ornament. It is said to have been invented by a spur-maker, not for show but for real utility. Till then the more elegant spurs in common use were made of solid silver, and from the flexibility of that metal they were liable to be bent into inconvenient forms by the slightest accident. To remedy this defect, a workman at Birmingham contrived to make the branches of a pair of spurs hollow, and to fill that hollow with a slender rod of steel or iron. Finding this a great improvement, and being desirous to add cheapness to utility, he continued to make the hollow larger, and of course the iron thicker and thicker, till at last he discovered the means of coating an iron spur with silver in such a manner as to make it equally elegant with those which were made wholly of that metal. The invention was quickly applied to other purposes; and to numberless utensils which were formerly made of brass or iron are now given the strength of these metals, and the elegance of silver, for a small additional expence.

The silver plate is generally made to adhere to the baser metal by means of solder; which is of two kinds, the *soft* and the *hard*, or the *tin* and *silver* solders. The former of these consists of tin alone, the latter generally of three parts of silver and one of brass. When a buckle, for instance, is to be plated by means of the soft solder, the ring, before it is bent, is first tinned, and then the silver-plate is gently hammered upon it, the hammer employed being always covered with a piece of cloth. The silver now forms, as it were, a mould to the ring, and whatever of it is not intended to be used is cut off. This mould is fastened to the ring of the buckle by two or three cramps of small iron-wire; after which the buckle, with the plated side undermost, is laid upon a plate of iron sufficiently hot to melt the tin, but not the silver. The buckle is then covered with powdered resin or anointed with turpentine; and lest there should be a deficiency of tin, a small portion of rolled tin is likewise melted on it. The buckle is now taken off with a tongs, and commonly laid on a bed of sand, where the plate and the ring, while the solder is yet in a state of fusion, are more closely compressed by a smart stroke with a block of wood. The buckle is afterwards bent and finished.

Sometimes the melted tin is poured into the silver mould, which has been previously rubbed over with some flux. The buckle ring is then put among the melted tin, and the plating finished. This is called by the workmen *filling up.*

When the hard solder is employed, the process is in many respects different. Before the plate is fitted to the iron or other metal, it is rubbed over with a solution of borax. Stripes of silver are placed along the joinings of the plate; and instead of two or three cramps, as in the former case, the whole is wrapped round with small wire; the solder and joinings are again rubbed with the borax, and the whole put into a charcoal fire till the solder be in fusion. When taken out, the wire is instantly removed, the plate is cleaned by the application of some acid, and afterwards made smooth by the strokes of a hammer.

Metal plating is when a bar of silver and copper are taken of at least one equal side. The equal sides are made smooth, and the two bars fastened together by wire wrapped round them. These bars are then sweated in a charcoal fire, and after sweating, they adhere as closely together as if they were soldered. After this they are flattened into a plate between two rollers, when the copper appears on one side and the silver on the other. This sort of plate is named *plated metal*.

French plating is when silver-leaf is burnished on a piece of metal in a certain degree of heat.

When silver is dissolved in aquafortis, and precipitated upon another metal, the process is called *silvering*. See SOLDERING.

PLATO, an illustrious philosopher of antiquity, was by descent an Athenian, though the place of his birth was the island of Egina. His lineage through his father is traced back to Codrus the last king of Athens, and through his mother to Solon the celebrated legislator. The time of his birth is commonly placed in the beginning of the 88th Olympiad; but Dr Enfield thinks it may be more accurately fixed in the third year of the 87th Olympiad, or 430 years before the Christian era. He gave early indications of an extensive and original genius, and had an education suitable to his high rank, being instructed in the rudiments of letters by the grammarian Dionysius, and trained in athletic exercises by Aristo of Argos. He applied with great diligence to the study of the arts of painting and poetry; and made such proficiency in the latter, as to produce an epic poem, which, upon comparing it with the poems of Homer, he committed to the flames. At the age of 20 he composed a dramatic piece; but after he had given it to the performers, happening to attend upon a discourse of Socrates, he was so captivated by his eloquence, that he reclaimed his tragedy, without suffering it to be acted, renounced the muses, burnt all his poems, and applied himself wholly to the study of wisdom.

It is thought that Plato's first masters in philosophy were Cratylus and Hermogenes, who taught the systems of Heraclitus and Parmenides; but when he was 20 years old, he attached himself wholly to Socrates, with whom he remained eight years in the relation of a scholar. During this period, he frequently displeased his companions, and sometimes even his master, by grafting upon the Socratic system opinions which were taken from some other stock. It was the practice of the scholars of Socrates to commit to writing the substance of their master's discourses. Plato wrote them in the form of dialogues; but with so great additions of his own, that Socrates, hearing him recite his Lysis, cried out, "O Hercules! how many things does this young man feign of me!"

Plato, however, retained the warmest attachment to his master. When that great and good man was summoned before the senate, his illustrious scholar undertook to plead his cause, and began a speech in his defence; but the partiality and violence of the judges would not permit him to proceed. After the condemnation, he presented his master with money sufficient to redeem his life; which, however, Socrates refused to accept. During his imprisonment, Plato attended him, and was present at a conversation which he held with his friends concerning the immortality of the soul; the substance of which he afterwards committed to writing in the beautiful dialogue intitled *Phædo*, not, however, without interweaving his own opinions and language.

The philosophers who were at Athens were so alarmed at the death of Socrates, that most of them fled from the city to avoid the injustice and cruelty of the government. Plato, whose grief upon this occasion is said by Plutarch to have been excessive, retired to Megara, where he was kindly entertained by Euclid, who had been one of Socrates's first scholars, till the storm was over. Afterwards he determined to travel in pursuit of knowledge; and from Megara he went to Italy, where he conferred with Eurytus, Philolaus, and Archytas. These were the most celebrated of the followers of Pythagoras, whose doctrine was then become famous in Greece; and from these the Pythagoreans have affirmed that he had all his natural philosophy. He dived into the most profound and mysterious secrets of the Pythagoric doctrines; and perceiving other knowledge to be connected with them, he went to Cyrene, where he learned geometry of Theodorus the mathematician. From thence he passed into Egypt, to acquaint himself with the theology of their priests, to study more nicely the proportions of geometry, and to instruct himself in astronomical observations; and having taken a full survey of all the country, he settled for some time in the province of Sais, learning of the wise men there, what they held concerning the universe, whether it had a beginning, whether it moved wholly or in part, &c.; and Pausanias affirms, that he learned from these the immortality, and also the transmigration, of souls. Some of the fathers will have it, that he had communication with the books of Moses, and that he studied under a learned Jew of Heliopolis; but there is nothing that can be called evidence for these assertions. St Austin once believed that Plato had some conference with Jeremiah; but afterwards discovered, that that prophet must have been dead at least 60 years before Plato's voyage to Egypt.

Plato's curiosity was not yet satisfied. He travelled into Persia to consult the magi about the religion of that country: and he designed to have penetrated even to the Indies, and have learned of the Brachmans their manners and customs; but the wars in Asia prevented him.

"He then returned into Italy, to the Pythagorean school at Tarentum, where he endeavoured to improve his own system, by incorporating with it the doctrine of Pythagoras, as it was then taught by Archytas, Timæus, and others. And afterwards, when he visited Sicily, he retained such an attachment to the Italic school, that, through the bounty of Dionysius, he purchased at a vast price several books which contained the doctrine of Pythagoras, from Philolaus, one of his followers.

"Returning home richly stored with knowledge of various kinds, Plato settled in Athens, and executed the design, which he had doubtless long had in contemplation, of forming a new school for the instruction of youth in the principles of philosophy. The place which he made choice of for this purpose was a public grove, called the *Academy*, from Hecademus, who left it to the citizens for the purpose of gymnastic exercises. Adorned with statues, temples, and sepulchres, planted with lofty plane-trees, and intersected by a gentle stream, it afforded a delightful retreat for philosophy and the muses. Of this delightful retreat Horace speaks:

Atque inter sylvas Academi quærere verum.

"'Midst Academic groves to search for truth."

Within this inclosure he possessed, as a part of his humble patrimony, purchased at the price of three thousand drachmas, a small garden, in which he opened a school for the reception of those who might be inclined to attend his instructions. How much Plato valued mathematical studies, and how necessary a preparation he thought them for higher speculations, appears from the inscription which he placed over the door of his school: 'Ουδεὶς αγεω μετρητος εισιτω. "Let no one who is unacquainted with geometry enter here."

"This new school soon became famous, and its master was ranked among the most eminent philosophers. His travels into distant countries, where learning and wisdom flourished, gave him celebrity among his brethren of the Socratic sect. None of these had ventured to institute a school in Athens except Aristippus; and he had confined his instructions almost entirely to ethical subjects, and had brought himself into some discredit by the freedom of his manners. Plato alone remained to inherit the patrimony of public esteem which Socrates had left his disciples; and he possessed talents and learning adequate to his design of extending the study of philosophy beyond the limits within which it had been inclosed by his master. The consequence was, not only that young men crowded to his school from every quarter, but that people of the first distinction in every department frequented the academy. Even females, disguised in men's clothes, often attended his lectures. Among the illustrious names which appear in the catalogue of his followers are Dion the Syracusan prince, and the orators Hyperides, Lycurgus, Demosthenes, and Isocrates.

"Greatness was never yet exempted from envy. The distinguished reputation of Plato brought upon him the hatred of his former companions in the school of Socrates, and they loaded him with detraction and obloquy. It can only be ascribed to mutual jealousy, that Xenophon and he, though they relate the discourses of their common master, studiously avoid mentioning one another. Diogenes the Cynic ridiculed Plato's doctrine of ideas and other abstract speculations. In the midst of these private censures, however, the public fame of Plato daily increased; and several states, among which were the Arcadians and Thebans, sent ambassadors with earnest requests that he would come over, not only to instruct the young men in philosophy, but also to prescribe them laws of government. The Cyrenians, Syracusans, Cretans, and Eleans, sent also to him: he did not go to any of them, but gave laws and rules of governing to all. He lived single, yet soberly and chastely. He was a man of great virtues, and exceedingly affable; of which we need no greater proof, than his civil manner of conversing with the philosophers of his own times, when pride and envy were at their height. His behaviour to Diogenes is always mentioned in his history. The Cynic was vastly offended, it seems, at the politeness and fine taste of Plato, and used to catch all opportunities of snarling at him. He dined one day at his table with other company, and trampling upon the tapestry with his dirty feet, uttered this brutish sarcasm, "I trample upon the pride of Plato;" to which Plato wisely reparteed, "With greater pride."

The fame of Plato drew disciples to him from all parts; among whom were Speusippus an Athenian, his sister's son, whom he appointed his successor in the academy, and the great Aristotle.

The admiration of this illustrious man was not confined to the breasts of a few philosophers. He was in high esteem with several princes, particularly Archelaus king of Macedon, and Dionysius tyrant of Sicily. At three different periods he visited the court of this latter prince, and made several bold but unsuccessful attempts to subdue his haughty and tyrannical spirit. A brief relation of the particulars of these visits to Sicily may serve to cast some light upon the character of our philosopher; and we shall give it in the words of Dr Enfield, from whose elegant history of philosophy we have extracted by much the most valuable parts of this article.

"The professed object of Plato's first visit to Sicily, which happened in the 40th year of his age, during the reign of the elder Dionysius the son of Hermocrates, was, to take a survey of the island, and particularly to observe the wonders of Mount Ætna. Whilst he was resident at Syracuse, he was employed in the instruction of Dion, the king's brother-in-law, who possessed excellent abilities, though hitherto restrained by the terrors of a tyrannical government, and relaxed by the luxuries of a licentious court. Disgusted by the debauched manners of the Syracusans, he endeavoured to rescue his pupil from the general depravity. Nor did Dion disappoint his preceptor's expectations. No sooner had he received a taste of that philosophy which leads to virtue, than he was fired with an ardent love of wisdom. Entertaining an hope that philosophy might produce the same effect upon Dionysius, he took great pains to procure an interview between Plato and the tyrant. In the course of the conference, whilst Plato was discoursing on the security and happiness of virtue, and the miseries attending injustice and oppression, Dionysius, perceiving that the philosopher's discourse was levelled against the vices and cruelties of his reign, dismissed him with high displeasure from his presence, and conceived a design against his life. It was not without great difficulty that Plato, by the assistance of Dion, made his escape. A vessel which had brought over Pollis, a delegate from Sparta, was fortunately at that time returning to Greece. Dion engaged Pollis to take the charge of the philosopher, and land him safely in his native country; but Dionysius discovered the design, and obtained a promise from Pollis, that he would either put him to death or sell him as a slave upon the passage. Pollis accordingly sold him in the island of Ægina; the inhabitants of which were then at war with the Athenians. Plato could not long remain unnoticed: Anicerris, a Cyrenaic philosopher, who happened to be at that time in the island, discovered the stranger, and thought himself happy in an opportunity of showing his respect for so illustrious a philosopher; he purchased his freedom for 30 minæ, or 84l. 10s. sterling money, and sent him home to Athens. Repayment being afterwards offered to Anicerris by Plato's relations, he refused the money, saying, with that generous spirit which true philosophy always inspires, that he saw no reason why the relations of Plato should engross to themselves the honour of serving him."

After a short interval, Dionysius repented of his ill-placed resentment, and wrote to Plato, earnestly requesting him to repair his credit by returning to Syracuse; to which Plato gave this high-spirited answer, that philosophy would not allow him leisure to think of Dionysius. He was, however, prevailed upon by his friend Dion to accept of the tyrant's invitation to return to Syracuse, and take upon him the education of Dionysius the younger, who was heir apparent to the monarchy. He was received by Dionysius the reigning sovereign with every possible appearance of respect; but after seeing his friend banished, and being himself kept as a prisoner at large in the palace, he was by the tyrant sent back into his own country, with a promise that both he and Dion should be recalled at the end of the war in which the Sicilians were then engaged. This promise was not fulfilled. The tyrant wished for the return of Plato, but could not resolve to recal Dion. At last, however, having probably promised that the philosopher should meet his friend at the court of Syracuse, he prevailed upon Plato to visit that capital a third time. When he arrived, the king met him in a magnificent chariot, and conducted him to his palace. The Sicilians too rejoiced in his return; for they hoped that the wisdom of Plato would at length triumph over the tyrannical spirit of the prince. Dionysius seemed wholly divested of his former resentments, listened with apparent pleasure to the philosopher's doctrine, and, among other expressions of regard, presented him with eighty talents of gold. In the midst of a numerous train of philosophers, Plato now possessed the chief influence and authority in the court of Syracuse. Whilst Aristippus was enjoying himself in splendid luxury; whilst Diogenes was freely indulging his acrimonious humour; and whilst Æschines was gratifying his thirst after riches;—Plato supported the credit of philosophy with an air of dignity, which his friends regarded as an indication of superior wisdom, but which his enemies imputed to pride. After all, it was not in the power of Plato to prevail upon Dionysius to adopt his system of policy, or to recal Dion from his exile. Mutual distrust, after a short interval, arose between the tyrant and the philosopher; each suspected the other of evil designs, and each endeavoured to conceal his suspicion under the disguise of respect. Dionysius attempted to impose upon Plato by condescending attentions, and Plato to deceive Dionysius by an appearance of confidence. At length, the philosopher became so much dissatisfied with his situation, that he earnestly requested permission to return to Greece, which was at last granted him, and he was sent home loaded with rich presents. On his way to Athens, passing through Elis during the celebration of the Olympic games, he was present at this general assembly of the Greeks, and engaged universal attention.

From this narrative it appears, that if Plato visited the courts of princes, it was chiefly from the hope of seeing his ideal plan of a republic realized; and that his talents and attainments rather qualified him to shine in the academy than in the council or the senate.

Plato, now restored to his country and his school, devoted himself to science, and spent the last years of a long life in the instruction of youth. Having enjoyed the advantage of an athletic constitution, and lived all his days temperately, he arrived at the 81st, or according to some writers the 79th, year of his age, and died, through the mere decay of nature, in the first year of the hundred and eighth Olympiad. He passed his whole life in a state of celibacy, and therefore left no natural heirs, but transferred his effects by will to his friend Adiamantus. The grove and garden, which had been the scene of his philosophical labours, at last afforded him a sepulchre. Statues and altars were erected to his memory; the day of his birth long continued to be celebrated as a festival by his followers; and his portrait is to this day preserved in gems: but the most lasting monuments of his genius are his writings, which have been transmitted, without material injury, to the present times.

The character of this philosopher has always been high. Besides the advantages of a noble birth, he had a large and comprehensive understanding, a vast fund of wit and good taste, great evenness and sweetness of temper, all cultivated and refined by education and travel; so that it is no wonder if he was honoured by his countrymen, esteemed by strangers, and adored by his scholars. The ancients thought more highly of Plato than of all their philosophers: they always called him the *Divine Plato;* and they seemed resolved that his descent should be more than human. "There are (says Apuleius) who assert Plato to have sprung from a more sublime conception; and that his mother Perictione, who was a very beautiful woman, was impregnated by Apollo in the shape of a spectre." Plutarch, Suidas, and others, affirm this to have been the common report at Athens. When he was an infant, his father Aristo went to Hymettus, with his wife and child, to sacrifice to the muses; and while they were busied in the divine rites, a swarm of bees came and distilled their honey upon his lips. This, says Tully, was considered as a presage of his future eloquence. Apuleius relates, that Socrates, the night before Plato was recommended to him, dreamed that a young swan fled from Cupid's altar in the academy, and settled in his lap; thence soared to heaven, and delighted the gods with its music: and when Aristo the next day presented Plato to him, "Friends (says Socrates), this is the swan of Cupid's academy." The Greeks loved fables: they show however in the present case, what exceeding respect was paid to the memory of Plato. Tully perfectly adored him; tells us, how he was justly called by Panætius the *divine*, the *most wise*, the *most sacred*, the *Homer of Philosophers;* entitled him to Atticus, *Deus ille noster;* thinks, that if Jupiter had spoken Greek, he would have spoken in Plato's language, and made him so implicitly his guide in wisdom and philosophy, as to declare, that he had rather err with Plato than be right with any one else. But, panegyric aside, Plato was certainly a very wonderful man, of a large and comprehensive mind, an imagination infinitely fertile, and of a most flowing and copious eloquence. Nevertheless, the strength and heat of fancy prevailing in his composition over judgment, he was too apt to soar beyond the limits of eathly things, to range in the imaginary regions of general and abstracted ideas; and on which account, though there is always a greatness and sublimity in his manner, he did not philosophize so much according to truth and nature as Aristotle, though Cicero did not scruple to give him the preference.

The writings of Plato are all in the way of dialogue; where he seems to deliver nothing from himself, but every thing as the sentiments and opinions of others, of Socrates chiefly, of Timæus, &c. He does not mention himself anywhere, except once in his Phædo, and another time in his Apology for Socrates. His style, as Aristotle observed, is betwixt prose and verse: on which account, some have not scrupled to rank him with the poets. There is a better reason for so doing than the elevation and grandeur of his style: his matter is oftentimes the offspring of imagination, instead of doctrines or truths deduced from nature. The first edition of Plato's work in Greek was put out by Aldus at Venice in 1513; but a Latin version of him by Marsilius Ficinus had been printed there in 1491. They were reprinted together at Lyons in 1588, and at Francfort in 1602. The famous printer Henry Stephens, in 1578, gave a most beautiful and correct edition of Plato's works at Paris, with a new Latin version by Serranus, in three volumes folio; and this deservedly passes for the best edition of Plato: yet Serranus's edition is very exceptionable, and in many respects, if not in all, inferior to that of Ficinus.

PLATONIC, something that relates to Plato, his school-philosophy, opinions, or the like. Thus, platonic love denotes a pure spiritual affection, for which Plato was a great advocate, subsisting between the different sexes, abstracted from all carnal appetites, and regarding no other object but the mind and its beauties; or it is even a sincere disinterested friendship subsisting between persons of the same sex, abstracted from any selfish views, and regarding no other object than the person, if any such love or friendship has aught of a foundation in nature.

Platonic Year, or the *Great Year*, is a period of time determined by the revolution of the equinoxes, or the space wherein the stars and constellations return to their former places in respect of the equinoxes. The platonic year, according to Tycho Brahe, is 25816, according to Ricciolus 25910, and according to Cassini 24800 years.

This period once accomplished, it was an opinion among the ancients that the world was to begin anew, and the same series of things to turn over again.

PLATONISM, the philosophy of Plato, which was divided into three branches, *theology*, *physics*, and *mathematics*. Under *theology* were comprehended metaphysics and ethics, or that which in modern language is called *moral* philosophy. Plato wrote likewise on *dialectics*, but with such inferiority to his pupil Aristotle, that his works in that department of science are seldom mentioned.

The ancient philosophers always began their theological systems with some disquisition on the nature of the gods, and the formation of the world; and it was a fundamental doctrine with them, that *from nothing nothing can proceed*. We are not to suppose that this general axiom implied nothing more than that for every effect there must be a cause; for this is a proposition which no man will controvert who understands the terms in which it is expressed: but the ancients believed that a proper creation is impossible even to omnipotence, and that to the production of any thing a *material* is not less *necessary* than an *efficient* cause (see METAPHYSICS, N° 264—304.). That with respect to this important question, Plato agreed with his predecessors and contemporaries, appears evident to us from the whole tenor of his *Timæus*. We agree with Dr Enfield[*] in thinking, that in this dialogue, which comprehends his whole doctrine on the subject of the formation of the universe, matter is so manifestly spoken of as eternally co-existing with God, that this part of his doctrine could not have been mistaken by so many learned and able writers, had they not been seduced by the desire of establishing a coincidence of doctrine between the writings of Plato and Moses. It is certain that neither Cicero[†], nor Apuleius[‡], nor Alcinous[§], nor even the later commentator Chalcidius, understood their master in any other sense than as admitting two primary and incorruptible principles, God and matter; to which we shall afterwards see reason to add a third, namely ideas. The passages quoted by those who maintain the contrary opinion are by no means sufficient for their purpose. Plato, it is true, in his Timæus, calls God the *parent of the universe*, and in his Sophista speaks of him as "forming animate and inanimate beings, which did not before exist:" but these expressions do not necessarily imply that this offspring of Deity was produced from nothing, or that no prior matter existed from which these new beings were formed. Through the whole dialogue of the Timæus, Plato supposes two eternal and independent causes of all things; one, that by which all things are made, which is God; the other, that from which all things are made, which is matter. He distinguishes between God, matter, and the universe, and supposes the architect of the world to have formed it out of a mass of pre-existent matter. Matter, according to Plato, is an eternal and infinite principle. His doctrine on this head is thus explained by Cicero[||]. "Matter, from which all things are produced and formed, is a substance without form or quality, but capable of receiving all forms, and undergoing every kind of change; in which, however, it never suffers annihilation, but merely a solution of its parts, which are in their nature infinitely divisible, and move in portions of space which are also infinitely divisible. When that principle which we call quality is moved, and acts upon matter, it undergoes an entire change, and these forms are produced, from which arises the diversified and coherent system of the universe." This doctrine Plato unfolds at large in his Timæus, and particularly insists upon the notion, that matter has originally no form, but is capable of receiving any. He calls it the mother and receptacle of forms, by the union of which with matter the universe becomes perceptible to the senses; and maintains, that the visible world owes its form to the energy of the divine intellectual nature.

Our author is supported in drawing this inference by the testimony of Diogenes Laertius, who surely understood the language and dogmas of Plato better than the most accomplished modern scholar can pretend to do; yet a learned writer[*] has lately expressed great surprise that any one should consider matter as having been, in Plato's opinion, uncreated; and he boldly affirms, that Laertius, instead of asserting that spirit and matter were the principles of all things, ought to have said that God alone, in Plato's estimation, was their original.—To prove this, he gives from the Timæus a quotation, in which the founder of the academy declares that God *framed* heaven and earth, and the inferior deities; and that as he *fashioned*, so he pervades all nature. He observes, that Cicero denominates the god of

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[*] *Hist. of Philosophy.*

[†] *Ac. Qu:* lib. i c. 6.

[‡] Lib. i.

[§] Cap. 12.

[||] *Ac. Qu.* lib. i. c. 8.

[*] *Dr Ogilvie.*

Theology of Plato.

Plato the *maker*, and the god of Aristotle only the *governor*, of the world. And, to satisfy those who may demand a particular proof of Plato's having taught a real creation, he affirms that his writings abound with declarations on the subject, of which the meaning cannot be misapprehended. "With this purpose (says he) Plato denominates at one time the principles or substance of all things, Γενοματα Θεου Δημιουργου, the productions of the efficient Deity, and at others enters more particularly into the question. Thus, he observes, that many persons are ignorant of the nature and power of mind or intellect, 'as having existed at the beginning, antecedent to all bodies.' Of this mind, he observes, that it is without exception Παντων πρεσβυτατι, *of all things the most ancient*; and he subjoins, in order to remove all doubt of his purpose, that it is also Αρχη κινησεως, *the cause or principle of motion.*"

With all possible respect for Dr Ogilvie, of whose piety and erudition we are thoroughly convinced, we must take the liberty to say, that to us the declarations of Plato on this subject appear much less precise and explicit than they appear to him; and that the inference which he would draw from the *words* of Cicero seems not to flow necessarily from the *sense* of those words. That Plato believed God to have *framed* the heaven and the earth, and to have *fashioned* all nature, is a position which as far as we know, has never been controverted; but between *framing* or *fashioning* the chaos or ὑλη πρωτη, and calling the universe into existence from nonentity, there is an infinite and an obvious difference. The distinction made by Cicero between the God of Plato and the God of Aristotle is a just distinction, but it will not bear the superstructure which the learned doctor builds upon it. Aristotle maintained the eternity of the world in its present form. Plato certainly taught that the first matter was in time reduced from a chaotic state into *form* by the power of the Demiurgus; but we have seen nothing in his writings which explicitly declares his belief that the *first matter* was itself *created*.

The learned Cudworth, who wished, like Dr Ogilvie, to find a coincidence of doctrine between the theology of Plato and that of the Gospel, strained all his faculties to prove that his favourite philosopher taught a proper creation: but he laboured in vain. He gives a number of quotations in support of his position; of which we shall here insert only those two upon which Dr Ogilvie seems to lay the greatest stress. Plato, says the author of the Intellectual System, calls the one God (A) ὁς γην ουρανον και θεους, και παντα τα εν ουρανω και τα εν ἁδου, και ὑπο γης ἁπαντα εργαζεται—*He that makes earth, and heaven, and the gods, and doth all things both in heaven, and hell, and under the earth.* And, again, "he by whose efficiency the things of the world (ὑστερον εγιγνετο, προτερον ουκ οντα) *were afterwards made when they were not before* *." Both Cudworth and Ogilvie think this last sentence an explicit declaration of Plato's belief in the creative power of God: but that they are mistaken has been evinced by Mosheim with a force of argument which will admit of no reply. In that part of *the Sophist* from which the quotation is taken, Plato considers the δυναμιν ποιητικην, of which he is treating, as belonging both to God and to man; and he defines it in general to be "a certain power which is the cause that things may afterwards be which were not before." Cudworth wishes to confine this definition to the divine power; and adds from himself to the text which he quotes the following words, which are not in Plato, or FROM AN ANTECEDENT NON-EXISTENCE BROUGHT FORTH INTO BEING! That the incomparable author intended to deceive his reader, we are far from imagining: his zeal for Platonism had deceived himself. Plato's definition comprehends the δυναμιν ποιητικην † as well of man as of God; and therefore cannot infer a creative power anywhere, unless the father of the academy was so very absurd as to suppose human artists the creators of those machines which they have invented and made! Mosheim thinks that Cudworth was misled by too implicit a confidence in *Ficinus;* and it is not impossible that Dr Ogilvie may have been swayed by the authority, great indeed, of the author of the Intellectual System.

That intellect existed antecedent to all bodies is indeed a Platonic dogma, from which Dr Ogilvie, after Cudworth, wishes to infer that the doctrine of the creation was taught in the academy; but Dr Ogilvie knows, and no man knew better than Cudworth, that Plato, with every other Greek philosopher, distinguished between *body* and *matter;* and that though he held the priority of intellect to the former, it by no means follows that he believed it to have existed antecedent to the latter. That he believed *mind*, or rather *soul* (for he distinguishes between the two), to be the cause or principle of motion, cannot be denied; but we are not therefore authorised to conclude, that he likewise believed it to be the cause of the existence of matter. That he believed mind to be the most ancient of *all things*, taking the word *things* in the most absolute sense, cannot be true, since by Dr Ogilvie's own acknowledgement he held the existence and eternity of *ideas*, not to add that he believed το ἑν or τ'αγαθον—the first hypostasis in his trinity, to be superior to mind and prior to it, though not in time, yet in the order of nature. When therefore he calls mind the most ancient of *all things*, he must be supposed to mean only, that it is more ancient than *all bodies* and inferior souls. It is no reflection on the character of Plato that he could not, by the efforts of his own reason, acquire any notion of a proper creation; since we, who have the advantage of his writings, and of writings

* Sophist, p. 161.

† Mosh. ed. Cud. Syst. Intel. cap. 4. § 15. n. 11.

(A) Mosheim affirms that this quotation is nowhere to be found in the writings of Plato. He therefore at first suspected that the learned author, in looking hastily over Plato's 10th book *De Legibus*, had transferred to God what is there said of the *anima mundi*, leading by its own motions every thing in the heaven, the earth, and the sea, and that he had added something of his own. He dropped that opinion, however, when he found Plato, in the 10th book of his Republic, declaring it to be as "easy for God to produce the sun, moon, stars, and earth, &c. from himself, as it is for us to produce the image of ourselves, and whatever else we please, only by interposing a looking glass." In all this power, however, there is nothing similar to that of creation.

writings infinitely more valuable, to instruct us, find it extremely difficult, if not impossible, to conceive how any thing can begin to be. We believe the fact on the authority of revelation; but should certainly have never agitated such a question, had it not been stated to us by writers inspired with celestial wisdom.

In the Platonic cosmogony we cannot therefore doubt but that the eternity of the υλη πρωτη was taken for granted. Whether it was an eternal and necessary emanation from an eternal mind, is not perhaps quite so evident, though our own opinion is, that it was believed to be self-existent. But be this as it may, which is not worth disputing, one thing is certain, that Plato did not believe it to have a single form or quality which it did not receive either from the *Demiurgus* or the *Psyche*—the second or third person of this trinity. Except Aristotle, all the Greek philosophers, who were not materialists, held nearly the same opinions respecting the origin of the world; so that in examining their systems we shall be greatly misled if we understand the terms *incorporeal* and *immaterial* as at all synonymous. It was also a doctrine of Plato, that there is in matter a necessary but blind and refractory force; and that hence arises a propensity in matter to disorder and deformity, which is the cause of all the imperfection which appears in the works of God, and the origin of evil. On this subject Plato writes with wonderful obscurity: but, as far as we are able to trace his conceptions, he appears to have thought, that matter, from its nature, resists the will of the Supreme Artificer, so that he cannot perfectly execute his designs; and that this is the cause of the mixture of good and evil which is found in the material world.

Plato, however, was no materialist. He taught, that there is an intelligent cause, which is the origin of all spiritual being, and the former of the material world. The nature of this great being he pronounced it difficult to discover, and when discovered, impossible to divulge. The existence of God he inferred from the marks of intelligence, which appear in the form and arrangement of bodies in the visible world: and from the unity of the material system he concluded, that the mind by which it was formed must be one. God, according to Plato, is the supreme intelligence, incorporeal, without beginning, end, or change, and capable of being perceived only by the mind. He certainly distinguished the Deity not only from body, and whatever has corporeal qualities, but from matter itself, from which all things are made. He also ascribed to him all those qualities which modern philosophers ascribe to immaterial substance: and conceived him to be in his nature simple, uncircumscribed in space, the author of all regulated motion, and, in fine, possessed of intelligence in the highest perfection.

His notions of God are indeed exceedingly refined, and such as it is difficult to suppose that he could ever have acquired but from some obscure remains of primeval tradition, gleaned perhaps from the priests of Egypt or from the philosophers of the East. In the Divine Nature he certainly believed that there are two, and probably that there are three, *hypostases*, whom he called το ον and το εν, νους, and ψυχη. The first he considered as self-existent, and elevated far above all mind and all knowledge; calling him, by way of eminence, *the being*, or *the one*. The only attribute which he acknowledged in this person was goodness; and therefore he frequently styles him το αγαθον—*the good*, or *essential goodness*. The second he considered as mind, the *wisdom* or *reason* of the first, and the *maker of the world;* and therefore he styles him νους, λογος, and δημιουργος. The third he always speaks of as the *soul of the world;* and hence calls him ψυχη, or ψυχη του κοσμου. He taught that the *second* is a necessary emanation from the *first*, and the *third* from the *second*, or perhaps from the *first* and *second*.

Some have indeed pretended, that the *Trinity*, which is commonly called *Platonic*, was a fiction of the later Platonists, unknown to the founder of the school: but any person who shall take the trouble to study the writings of Plato, will find abundant evidence that he really asserted a triad of divine hypostases, all concerned in the formation and government of the world. Thus in his 10th book of Laws, where he undertakes to prove the existence of a Deity in opposition to atheists, he ascends no higher in the demonstration than to the ψυχη or mundane soul, which he held to be the immediate and proper cause of all the motion that is in the world. But in other parts of his writings he frequently asserts, as superior to the self-moving principle, an immoveable νους or intellect, which was properly the *demiurgus* or framer of the world; and above this *hypostasis* one most simple and absolutely perfect being, who is considered in his *Theology* as αυτοθεος, the *original deity*, in contradistinction from the others, who are only θεοι εκ θεου. These doctrines are to be gathered from his works at large, particularly from the *Timæus*, *Philebus*, *Sophista* and *Epinomis:* but there is a passage in his second epistle to Dionysius, apparently written in answer to a letter, in which that monarch had required him to give a more explicit account than he had formerly done of the nature of God, in which the doctrine of a Trinity seems to be directly asserted. "After having said that he meant to wrap up his meaning in such obscurity, as that an adept only should fully comprehend it, he adds expressions to the following import: 'The Lord of Nature is surrounded on all sides by his works: whatever is exists by his permission: he is the fountain and source of excellence: around the second person are placed things of the second order; and around the third those of the third degree (B).'" Of this obscure passage a very satisfactory explanation is given in Dr Ogilvie's *Theology of Plato*, to which the narrow limits prescribed to such articles as this compel us to refer the reader. We shall only say, that the account which we have given of the Platonic trinity is ably supported by the doctor.

In treating of the eternal emanation of the second and third hypostases from the first, the philosophers of the academy compare them to light and heat proceeding from the sun. Plato himself, as quoted by Dr Cudworth, illustrates his doctrine by the same comparison.

(B) "Περι των παντων βασιλεα, παντ' εστι και Εκεινου ενεκα παντα. Εκεινος αιτια παντων των καλων. Δευτερον δε περι τα δευτερα, και τριτον περι τα τριτα. Oper. p. 1269.

For " τ'αγαθον, or the first hypostasis, is in the intellectual world the same (he says) to intellect and intelligibles that the sun is in the corporeal world to vision and visibles; for as the sun is not vision itself but the cause of vision, and as that light by which we see is not the sun but only a thing like the sun; so neither is the Supreme or Highest Good properly knowledge, but the cause of knowledge; nor is intellect, considered as such, the best and most perfect being, but only a being having the form of perfection." Again, " as the sun causes other things not only to become visible but also to be generated; so the Supreme Good gives to things not only their capability of being known, but also their very essences by which they subsist; for this fountain of the Deity, this highest good, is not itself properly essence, but above essence, transcending it in respect both of dignity and of power."

The resemblance which this trinity of Plato bears to that revealed in the gospel must be observed by every attentive reader; but the two doctrines are likewise in some respects exceedingly dissimilar. The third hypostasis in the Platonic system appears in no point of view co-ordinate with the first or second. Indeed the first is elevated far above the second, and the third sunk still farther beneath it, being considered as a mere soul immersed in matter, and forming with the corporeal world, to which it is united, one compound animal. Nay, it does not appear perfectly clear, that Plato considered his ψυχη του κοσμου as a pure spirit, or as having subsisted from eternity as a distinct *Hypostasis.* " This governing spirit, of whom the earth, properly so called, is the body, consisted, according to our author's philosophy, of the same and the other; that is, of the first matter, and of pure intelligence, framed to actuate the machinery of nature. The Supreme Being placed him in the middle of the earth; which, in the vivid idea of Plato, seemed itself to live, in consequence of an influence that was felt in every part of it. From this seat his power is represented as being extended on all sides to the utmost limit of the heavens; conferring life, and preserving harmony in the various and complicated parts of the universe. Upon this being God is said to have looked with peculiar complacency after having formed him as an image of himself, and to have given beauty and perfect proportion to the mansion which he was destined to occupy. According to the doctrine of Timæus, the Supreme Being struck out from this original mind innumerable spirits of inferior order, endowed with principles of reason; and he committed to divinities of secondary rank the task of investing these in material forms, and of dispersing them as inhabitants of the sun, moon, and other celestial bodies. He taught also, that at death the human soul is reunited to the ψυχη του κοσμου, as to the source from which it originally came."

Such is the third person of the Platonic triad, as we find his nature and attributes very accurately stated by Dr Ogilvie; and the Christian philosopher, who has no particular system to support, will not require another proof that the triad of Plato differs exceedingly from the Trinity of the Scriptures. Indeed the third hypostasis in this triad has so much the appearance of all that the ancients could mean by that which we call a *creature*, that the learned Cudworth, who wished, it is difficult to conceive for what reason, to find the sublimest mystery of the Christian faith explicitly taught in the writings of a pagan philosopher, was forced to suppose that Plato held a double ψυχη, or soul, one εγκοσμιον, incorporated with the material world, and the other υπερκοσμιον or *supramundane*, which is not the soul but the governor of the universe. We call this a mere hypothesis; for though the author displays vast erudition, and adduces many quotations in which this double *psyche* is plainly mentioned, yet all those quotations are taken from Platonists who lived after the propagation of the gospel, and who, calling themselves *eclectics*, freely stole from every sect such dogmas as they could incorporate with their own system, and then attributed those dogmas to their master. In the writings of Plato himself, there is not so much as an allusion to this supramundane *psyche* *; and it is for this reason (the ψυχη, of which he treats being so very inferior to the δημιουργος and αγαθον) that we have expressed with hesitation his belief of *three* hypostases in the divine nature. Yet that he did admit so many, seems more than probable both from the passage illustrated by Dr Ogilvie, and from the attempt of Plotinus, one of his followers, to demonstrate that the number can be neither greater nor less. That his doctrine on this subject should be inaccurate and erroneous, can excite no wonder; whilst it must be confessed to have such a resemblance to the truth, and to be so incapable of being proved by reasoning from effects to causes, that we could not doubt of his having inherited it by tradition, even though we had not complete evidence that something very similar to it was taught long before him, not only by Pythagoras and Parmenides, but by the philosophers of the east.

We have said that the Demiurgus was the maker of the world from the first matter which had existed from eternity; but in Plato's cosmogony there is another principle, more mysterious, if possible, than any thing which we have yet mentioned. This is his intellectual system of *ideas*, which it is not easy to collect from his writings, whether he considered as *independent* existences, or only as archetypal *forms*, which had subsisted from eternity in the λογος or divine intellect. On this subject he writes with such exceeding obscurity, that men of the first eminence, both among the ancients and the moderns, have differed about his real meaning. Some have supposed, that by *ideas* he meant real beings subsisting from eternity, independent of all minds, and separate from all matter; and that of these ideas he conceived some to be living and others to be without life. In this manner his doctrine is interpreted by Tertullian * among the ancients, and by the celebrated Brucker † among the moderns; and not by them only, but by many others equally learned, candid, and acute. Cudworth, on the other hand, with his annotator Mosheim, contend, that by his ideal world Plato meant nothing more than that there existed from eternity in the λογος or mind of God a notion or conception of every thing which was in time to be made. This is certainly much more probable in itself, than that a man of enlarged understanding should have supposed, that there are somewhere in extramundane space real living incorporeal beings eating and drinking, which are the *ideas* of all the animals which ever have been or ever will be eating and drinking in this world. Yet Mosheim candidly acknowledges, that if the controversy were to be decided by the votes of the learned, he is doubtful whether it would be given for or against him; and Cudworth, though he pleads the cause of his master with much ingenuity, owns, that on this subject his language cannot be vindicated. This indeed is most true; for Plato contends, that his ideas are not only the objects of science, but also the proper or physical causes of all things here below; that the *idea* of similitude is the *cause* of the resemblance between two globes: and the idea of dissimilitude the cause that a globe does not resemble a pyramid: he likewise calls them *ουσιας*, *essences* or *substances*, and many of his followers have pronounced them to be *animals*.

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* Mosh. ed. Cud. Syst. Intel. c. 4. § n. 45.

* Lib. de Anima.

† Histor. Doctrin. de Ideis.

These wonderful expressions incline us to adopt with some hesitation the opinion stated by Dr Enfield. This historian of philosophy having observed, that some of the admirers of Plato contend, that by ideas existing in the reason of God, nothing more is meant than conceptions formed in the Divine mind, controverts this opinion with much effect. "By ideas, Plato (says he) appears to have meant something much more mysterious; namely, patterns or archetypes subsisting by themselves, as real beings, *οντως οντα* in the Divine reason, as in their original and eternal region, and issuing thence to give form to sensible things, and to become objects of contemplation and science to rational beings. It is the doctrine of the Timæus, that *ὁ λογίσμος τȣ Θεȣ*, the reason of God, comprehends exemplars of all things, and that this reason is one of the primary causes of things. Plutarch says, that Plato supposes three principles, God, Matter, and Idea. Justin Martyr, Pseudo-Origen, and others, assert the same thing.

"That this is the true Platonic doctrine of ideas will appear probable, if we attend to the manner in which Plato framed his system of opinions concerning the origin of things. 'Having been from his youth (says Aristotle) conversant with Cratylus, a disciple of Heraclitus, and instructed in the doctrine of that school, that all sensible things are variable, and cannot be proper objects of science, he reasonably concluded, that if there be any such thing as science, there must exist, besides sensible objects, certain permanent natures, perceptible only by the intellect.' Such natures, divine in their origin, and eternal and immutable in their existence, he admitted into his system, and called them *ideas*. Visible things were regarded by Plato as fleeting shades, and ideas as the only permanent substances. These he conceived to be the proper objects of science to a mind raised by divine contemplation above the perpetually varying scenes of the material world."

It was a fundamental doctrine in the system of Plato, that the Deity formed the material world after a perfect model, consisting of those ideas which had eternally subsisted in his own reason; and yet, with some appearance of contradiction, he calls this model "*self*-existent, indivisible, and eternally *generated*." Nay, he talks of it as being intelligent as well as eternal, and wholly different from the transcripts, which are subjected to our inspection. There is so much mystery, confusion, and apparent absurdity, in the whole of this system, as it has come down to us, that we must suppose the friends of Plato to have been entrusted with a key to his esoteric doctrines, which has long been lost, otherwise it would be difficult to conceive how that philosopher could have had so many admirers.

With almost every ancient theist of Greece the founder of the academy believed in an order of beings called *dæmons*, which were superior to the souls of men, and struck off by the Demiurgus from the soul of the world. Of these the reader will find some account elsewhere: (see DÆMON and POLYTHEISM). We mention them at present because they make an important appearance in Plato's system of physics, which was built upon them and upon the doctrine which has been stated concerning God, matter, and ideas. He taught, that the visible world was formed by the Supreme Architect, uniting eternal and immutable ideas to the first matter; that the universe is one animated being[*], including within its limits all animated natures; that, in the formation of the visible and tangible world, fire and earth were first formed, and were afterwards united by means of air and water; and from perfect parts one perfect whole was produced, of a spherical figure, as most beautiful in itself, and best suited to contain all other figures[†]; that the elementary parts of the world are of regular geometrical forms, the particles of earth being cubical, those of fire pyramidical, those of air in the form of an octohedron, and those of water in that of an icosohedron; that these are adjusted in number, measure, and power, in perfect conformity to the geometrical laws of proportion; that the soul which pervades this sphere is the cause of its revolution round its centre; and, lastly, that the world will remain for ever, but that by the action of its animating principle, it accomplishes certain periods, within which every thing returns to its ancient place and state. This periodical revolution of nature is called the *Platonic* or *great year*. See the preceding article.

The metaphysical doctrines of Plato, which treat of the human soul, and the principles of his system of ethics, have been detailed in other articles (See METAPHYSICS, Part III. chap. iv.; and MORAL *Philosophy*, N° 6.) but it is worthy of observation in this place, that, preparatory to the study of all philosophy, he required from his disciples a knowledge of the elements of mathematics. In his Republic, he makes Glaucus, one of the speakers, recommend them for their usefulness in human life. "Arithmetic for accounts and distributions; geometry for encampments and mensurations; music for solemn festivals in honour of the gods; and astronomy for agriculture, for navigation, and the like. Socrates, on his part, denies not the truth of all this, but still insinuates that they were capable of answering an end more sublime. 'You are pleasant (says he) in your seeming to fear the multitude, lest you should be thought to enjoin certain sciences that are useless. 'Tis indeed no contemptible matter, though a difficult one, to believe that through these particular sciences the soul has an organ purified and enlightened, which is destroyed and blinded by studies of other kinds; an organ better worth saving than a thousand eyes, in as much as *truth* becomes visible through *this alone*."

"Concerning policy, Plato has written at large in his Republic and in his Dialogue on Laws. He was so much enamoured with his own conceptions on this subject, that it was chiefly the hope of having an opportunity to realise his plan of a republic which induced him to visit the court of Dionysius. But they who are conversant with mankind, and capable of calmly investigating the springs of human actions, will easily perceive that his projects were chimerical, and could only have originated in a mind replete with philosophical enthusiasm. Of this nothing can be a clearer proof than the design of admitting in his republic a community of women, in order to give reason an entire controul over desire. The main object of his political institutions appears to have been, the subjugation of the passions and appetites, by means of the abstract contemplation of ideas. A system of policy, raised upon such fanciful grounds, cannot merit a more distinct consideration."

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[*] Timæus.

[†] Ibid.

Such is genuine Platonism as it was taught in the old academy by the founder of the school and his immediate followers; but when Arcesilaus was placed at the head of the academics, great innovations were introduced both into their doctrines and into their mode of teaching (see ARCESILAUS). This man was therefore considered as the founder of what was afterwards called the *middle* academy. Being a professed sceptic, he carried his maxim of uncertainty to such a height, as to alarm the general body of philosophers, offend the governors of the state, and bring just odium upon the very name of the academy. At length *Carneades*, one of the disciples of this school, relinquishing some of the more obnoxious tenets of Arcesilaus, founded what has been called the *new* academy with very little improvement on the principles of the middle. See CARNEADES.

Under one or other of these forms Platonism found its way into the Roman republic. Cicero was a Platonist, and one of the greatest ornaments of the school. A school of Platonists was likewise founded in Alexandria in the second century of the Christian era; but their doctrines differed in many particulars from those taught in the three academies. They professed to seek truth wherever they could find it, and to collect their dogmas from every school. They endeavoured to bend some of the principles of Plato into a conformity with the doctrines of the gospel; and they incorporated with the whole many of the maxims of Aristotle and Zeno, and not a few of the fictions of the east. Their system was therefore extremely heterogeneous, and seldom so rational as that of the philosopher after whose name they were called, and of whose doctrines we have given so copious a detail. See AMMONIUS, ECCLECTICS, and PLOTINUS.

PLAUTUS, MARCUS ACCIUS, a comic writer of ancient Rome, born in Umbria, a province of Italy. His proper name was *Marcus Accius*, and he is supposed to have acquired the surname of *Plautus* from having splay feet. His parentage appears to have been mean; so that some have thought he was the son of a slave. Aulus Gellius says that Plautus was distinguished for his poetry on the theatre, and Cato for his eloquence in the forum, at the same time; and observes elsewhere from Varro, that he was so well paid for his plays as to double his stock in trading, in which he lost all he gained by the muses. He is said to have been reduced to work at a mill for his subsistence; but Varro adds, that his wit was his best support, as he composed three of his plays during this drudgery. He died in the first year of the elder Cato's censorship, about the year of Rome 569, and 184 before Christ. We have 20 of his plays extant, though not all of them entire. Five of them comedies, have been elegantly translated into English by Mr B. Thornton, and published in 2 vols 8vo, 1767.

PLAYS. See the following article.

PLAYHOUSE. See THEATRE, AMPHITHEATRE, &c. The most ancient English playhouses were the Curtain in Shoreditch and the Theatre. In the time of Shakespeare, who commenced a dramatic writer in 1592, there were no less than 10 theatres open. Four of these were private houses, viz. that in Blackfriars, the Cockpit or Phœnix in Drury-Lane, a theatre in Whitefriars, and one in Salisbury court. The other six were called public theatres, viz. the Globe, the Swan, the Rose, and the Hope, on the Bank-side; the Red Bull, at the upper end of St John's street, and the Fortune in White-cross street. The two last were chiefly frequented by citizens. Mr Malone gives us a pretty copious account of these playhouses, in a supplement to his last edition of Shakespeare, which we shall here insert.

"Most, if not all (says he) of Shakespeare's plays were performed either at the Globe or at the Theatre in Blackfriars. It appears that they both belonged to the same company of comedians, viz. his majesty's servants, which title they assumed, after a licence had been granted to them by King James in 1603, having before that time been called the servants of the lord chamberlain.

"The theatre in Blackfriars was a private house; but the peculiar and distinguishing marks of a private playhouse it is not easy to ascertain. It was very small, and plays were there usually represented by candle light. The Globe, situated on the southern side of the river Thames, was a hexagonal building, partly open to the weather, partly covered with reeds. It was a public theatre, and of considerable size, and there they always acted by daylight. On the roof of the Globe, and the other public theatres, a pole was erected, to which a flag was affixed. These flags were probably displayed only during the hours of exhibition; and it should seem from a passage in one of the old comedies that they were taken down during Lent, in which season no plays were presented. The Globe, though hexagonal at the outside, was probably a rotunda within, and perhaps had its name from its circular form. It might, however, have been denominated only from its sign, which was a figure of Hercules supporting the Globe. This theatre was burnt down in 1613, but it was rebuilt in the following year, and decorated with more ornament than had been originally bestowed upon it. The exhibitions at the Globe seem to have been calculated chiefly for the lower class of people; those at Blackfriars for a more select and judicious audience.

"A writer informs us, that one of these theatres was a winter and the other a summer house. As the Globe was partly exposed to the weather, and they acted there usually by daylight, it was probably the summer theatre. The exhibitions here seem to have been more frequent than at Blackfriars, at least till the year 1604 or 1605, when the Bank-side appears to have become less fashionable and less frequented than it formerly had been. Many of our ancient dramatic pieces were performed in the yards of carriers inns; in which, in the beginning of Queen Elizabeth's reign, the comedians, who then first united themselves in companies, erected an occasional stage. The form of these temporary playhouses seems to be preserved in our modern theatre. The galleries are in both ranged over each other on three sides of the building. The small rooms under the lowest of these galleries answer to our present boxes; and it is observable that these, even in theatres which were built in a subsequent period expressly for dramatic exhibitions, still retained their old name, and are frequently called rooms by our ancient writers. The yard bears a sufficient resemblance to the pit as at present in use. We may suppose the stage to have been raised in this area, on the fourth side, with its back to the gateway of the inn, at which the money for admission was taken. Hence, in the middle of the Globe, and I suppose of the other public theatres, in the time of Shakespeare, there was an open yard or area, where the common people stood to see the exhibition; from which circumstance they are called by our author groundlings, and by Ben Jonson 'the understanding gentlemen of the ground.'

"In the ancient playhouses there appears to have been a private box, of which it is not easy to ascertain the situation. It seems to have been placed at the side of the stage towards the rear, and to have been at a lower price: in this some people sat, either from economy or singularity. The galleries, or scaffolds as they are sometimes called, and that part of the house which in private theatres was named the pit, seem to have been at the same price; and probably in houses of reputation, such as the Globe, and that in Blackfriars, the price of admission into those parts of the theatres was 6d. while in some meaner playhouses it was only 1d. in others only 2d. The price of admission into the best rooms or boxes was, I believe, in our author's time, 1s.; though afterwards it appears to have risen to 2s. and half-a-crown.

"From several passages in our old plays, we learn, that spectators were admitted on the stage, and that the critics and wits of the time usually sat there. Some were placed on the ground; others sat on stools, of which the price was either 6d. or 1s. according, I suppose, to the commodiousness of the situation; and they were attended by pages, who furnished them with pipes and tobacco, which was smoked here as well as in other parts of the house: yet it should seem that persons were suffered to sit on the stage only in the private playhouses, such as Blackfriars, &c. where the audience was more select, and of a higher class; and that in the Globe and other public theatres no such licence was permitted.

"The stage was strewed with rushes, which, as we learn from Hentzner and Caius de Ephemera, was, in the time of Shakespeare, the usual covering of floors in England. The curtain which hangs in the front of the present stage, drawn up by lines and pulleys, though not a modern invention, for it was used by Inigo Jones in the masques at court, was yet an apparatus to which the simple mechanism of our ancient theatres had not arrived, for in them the curtains opened in the middle, and were drawn backwards and forwards on an iron rod. In some playhouses they were woollen, in others made of silk.—Towards the rear of the stage there appears to have been a balcony, the platform of which was probably eight or ten feet from the ground. I suppose it to have been supported by pillars. From hence, in many of our old plays, part of the dialogue was spoken; and in the front of this balcony curtains likewise were hung.

"A doubt has been entertained whether in our ancient theatres there were side and other scenes. The question is involved in so much obscurity, that it is very difficult to form any decided opinion upon it. It is certain, that in the year 1695 Inigo Jones exhibited an entertainment at Oxford, in which moveable scenes were used; but he appears to have introduced several pieces of machinery in the masques at court, with which undoubtedly the public theatres were unacquainted. A passage which has been produced from one of the old comedies, proves, it must be owned, that even these were furnished with some pieces of machinery, which were used when it was requisite to exhibit the descent of some god or saint; but from all the contemporary accounts, I am inclined to believe that the mechanism of our ancient stage seldom went beyond a painted chair or a trap door, and that few, if any of them, had any moveable scenes. When King Henry VIII. is to be discovered by the dukes of Suffolk and Norfolk, reading in his study, the scenical direction in the first folio, 1623, which was printed apparently from playhouse copies, is, 'the king draws the curtain, (i. e. draws it open), and sits reading pensively;' for, besides the principal curtains that hung in the front of the stage, they used others as substitutes for scenes. If a bed-chamber is to be exhibited, no change of scene is mentioned; but the property-man is simply ordered to thrust forth a bed. When the fable requires the Roman capitol to be exhibited, we find two officers enter, 'to lay cushions, as it were, in the capitol,' &c. On the whole, it appears, that our ancient theatres, in general, were only furnished with curtains, and a single scene composed of tapestry, which were sometimes, perhaps, ornamented with pictures; and some passages in our old dramas incline one to think, that when tragedies were performed the stage was hung with black.

"In the early part, at least, of our author's * acquaintance with the theatre, the want of scenery seems to have been supplied by the simple expedient of writing the names of the different places where the scene was laid in the progress of the play, which were disposed in such a manner as to be visible to the audience. The invention of trap-doors, however, appears not to be modern; for in an old *morality*, intitled *All for Money*, we find a marginal direction which implies that they were very early in use. The covering, or internal roof of the stage, was anciently termed the heavens. It was probably painted of a sky-blue colour, or perhaps pieces of drapery tinged with blue were suspended across the stage to represent the heavens.

"It is probable that the stage was formerly lighted by two large branches, of a form similar to those now hung in churches. They gave place in a subsequent period to small circular wooden frames, furnished with candles, eight of which were hung on the stage, four at either side, and these within a few years were wholly removed by Mr Garrick, who, on his return from France, first introduced the present commodious method of illuminating the stage by lights not visible to the audience. Many of the companies of players were formerly so thin, that one person played two or three parts; and a battle on which the fate of an empire was supposed to depend was decided by half a dozen combatants. It appears to have been a common practice in their mock engagements to discharge small pieces of ordnance on the stage. Before the exhibition began, three flourishes or pieces of music were played, or, in the ancient language, there were three soundings. Music was likewise played between the acts. The instruments chiefly used were trumpets, cornets, and hautboys

* *Shakespeare.*

hautboys. The band, which did not consist of more than five or six performers, sat in an upper balcony, over what is now called the stage-box.

"The person who spoke the prologue was ushered in by trumpets, and usually wore a long black velvet cloak, which, I suppose, was considered as best suited to a supplicatory address. Of this custom, whatever might have been its origin, some traces remained till very lately, a black coat having been, if I mistake not, within these few years, the constant stage-habiliment of our modern prologue speakers. The dress of the ancient prologue-speaker is still retained in the play that is exhibited in Hamlet before the king and court of Denmark. The performers of male characters generally wore periwigs, which in the age of Shakespeare were not in common use. It appears from a passage in Puttenham's *Art of English Poesy*, 1589, that vizards were on some occasions used by the actors of those days; and it may be inferred, from a scene in one of our author's comedies, that they were sometimes worn in his time by those who performed female characters; but this I imagine was very rare. Some of the female part of the audience likewise appeared in masks. The stage-dresses, it is reasonable to suppose, were much more costly at some theatres than at others; yet the wardrobe of even the king's servants at the Globe and Blackfriars, was, we find, but scantily furnished; and our author's dramas derived very little aid from the splendour of exhibition.

"It is well known, that in the time of Shakespeare, and for many years afterwards, female characters were represented by boys or young men. Sir William d' Avenant, in imitation of the foreign theatres, first introduced females in the scene, and Mrs Betterton is said to have been the first woman that appeared on the English stage. Andrew Pennycuike played the part of Matilda in a tragedy of Davenport's, in 1655; and Mr Kynaston acted several female parts after the Restoration. Downes, a contemporary of his, assures us, 'that being then very young he made a complete stage beauty, performing his parts so well, particularly Arthiope and Aglaura, that it has since been disputable among the judicious whether any woman that succeeded him touched the audience so sensibly as he.'

"Both the prompter, or book-holder, as he was sometimes called, and the property-man, appear to have been regular appendages of our ancient theatres. No writer that I have met with intimates, that in the time of Shakespeare it was customary to exhibit more than a single dramatic piece in one day. The Yorkshire tragedy, or *All's One*, indeed, appears to have been one of four pieces that were represented on the same day; and Fletcher has also a piece called *Four Plays in One;* but probably these were either exhibited on some particular occasion, or were ineffectual efforts to introduce a new species of amusement; for we do not find any other instances of the same kind. Had any shorter pieces been exhibited after the principal performance, some of them probably would have been printed: but there are none extant of an earlier date than the time of the Restoration. The practice, therefore, of exhibiting two dramas successively in the same evening, we may be assured was not established before that period. But though the audiences in the time of our author were not gratified by the representation of more than one drama in the same day, the entertainment was diversified, and the populace diverted, by vaulting, tumbling, slight of hand, and morris-dancing, a mixture not much more heterogeneous than that with which we are daily presented, a tragedy and a farce.

"The amusements of our ancestors, before the commencement of the play, were of various kinds, such as reading, playing cards, drinking ale, or smoking tobacco. It was a common practice to carry table-books to the theatre, and either from curiosity or enmity to the author, or some other motive, to write down passages of the play that was represented: and there is reason to believe that the imperfect and mutilated copies of some of Shakespeare's dramas, which are yet extant, were taken down in short-hand during the exhibition. At the end of the piece, the actors, in noblemen's houses and in taverns, where plays were frequently performed, prayed for the health and prosperity of their patrons; and in the public theatres for the king and queen. This prayer sometimes made part of the epilogue. Hence, probably, as Mr Steevens has observed, the addition of *Vivant rex et regina* to the modern play-bills.

"Plays, in the time of our author, began at one o'clock in the afternoon; and the exhibition was usually finished in two hours. Even in 1667 they commenced at three. When Gosson wrote his *School of Abuse*, in 1579, it seems the dramatic entertainments were usually exhibited on Sundays. Afterwards they were performed on that and other days indiscriminately. It appears from a contemporary writer, that exhibiting plays on Sunday had not been abolished in the third year of King Charles I.

"The modes of conveyance to the theatre, anciently as at present, seem to have been various; some going in coaches, others on horseback, and many by water.—To the Globe playhouse the company probably were conveyed by water; to that in Blackfriars the gentry went either in coaches or on horseback, and the common people on foot. In an epigram to Sir John Davis, the practice of riding to the theatre is ridiculed as a piece of affectation or vanity, and therefore we may presume it was not very general.

"The long and whimsical titles that are prefixed to the quarto copies of our author's plays, I suppose to have been transcribed from the play-bills of the time. A contemporary writer has preserved something like a play-bill of those days, which seems to corroborate this observation; for if it were divested of rhime, it would bear no very distant resemblance to the title pages that stand before some of our author's dramas:

" ———Prithee, what's the play?
" (The first I visited this twelvemonth day)
" They say " A new invented play of Purle,
" That jeoparded his neck to steal a girl
" Of twelve; and lying fast impounded for't,
" Has hither sent his beard to act his part;
" Against all those in open malice bent,
" That would not freely to the theft consent:
" Feigns all to's wish, and in the epilogue
" Goes out applauded for a famous rogue."
" —Now hang me if I did not look at first
" For some such stuff, by the fond people's thrust."

"It is uncertain at what time the usage of giving authors a benefit on the third day of the exhibition of their pieces commenced. Mr Oldys, in one of his manuscripts, intimates that dramatic poets had anciently their benefit on the first day that a new play was represented; a regulation which would have been very favourable to some of the ephemeral productions of modern times. But for this there is not, I believe, any sufficient authority. From D'Avenant, indeed, we learn, that in the latter part of the reign of Queen Elizabeth the poet had his benefit on the second day. As it was a general practice in the time of Shakespeare to sell the copy of the play to the theatre, I imagine in such cases an author derived no other advantage from his piece than what arose from the sale of it. Sometimes, however, he found it more beneficial to retain the copyright in his own hands; and when he did so, I suppose he had a benefit. It is certain that the giving authors the profit of the third exhibition of their play, which seems to have been the usual mode during almost the whole of the last century, was an established custom in the year 1612; for Decker, in the prologue to one of his comedies printed in that year, speaks of the poet's third day. The unfortunate Otway had no more than one benefit on the production of a new play; and this too, it seems, he was sometimes forced to mortgage before the piece was acted. Southerne was the first dramatic writer who obtained the emoluments arising from two representations; and to Farquhar, in the year 1700, the benefit of a third was granted. When an author sold his piece to the sharers or proprietors of a theatre, it remained for several years unpublished; but when that was not the case, he printed it for sale, to which many seem to have been induced, from an apprehension that an imperfect copy might be issued from the press without their consent. The customary price of the copy of a play in the time of Shakespeare appears to have been twenty nobles, or six pounds thirteen shillings and four pence. The play when printed was sold for sixpence; and the usual present from a patron in return for a dedication was forty shillings. On the first day of exhibiting a new play, the prices of admission appear to have been raised; and this seems to have been occasionally practised on the benefit-nights of authors to the end of the last century. The custom of passing a final censure on plays at their first exhibition is as ancient as the time of our author; for no less than three plays of his rival Ben Jonson appear to have been damned; and Fletcher's Faithful Shepherdess, and The Knight of the Burning Pestle, written by him and Beaumont, underwent the same fate.

"It is not easy to ascertain what were the emoluments of a successful actor in the time of Shakespeare. They had not then annual benefits as at present. The performers at each theatre seem to have shared the profits arising either from each day's exhibition or from the whole season among them. From Ben Johnson's Poetaster we learn, that one of either the performers or proprietors had seven shares and a half; but of what integral sum is not mentioned. From the prices of admission into our ancient theatres, which have been already mentioned, I imagine the utmost that the shares of the Globe playhouse could have received on any one day was about 35l. So lately as the year 1685, Shadwell received by his third day on the representation of the Squire of Alsatia, 130l.: which Downes the prompter says was the greatest receipt that had been ever taken at Drury-Lane playhouse at single prices. It appears from the MSS. of Lord Stanhope, treasurer of the chambers to King James I. that the customary sum paid to John Heminge and his company for the performance of a play at court was twenty nobles, or six pounds thirteen shillings and four pence. And Edward Alleyn mentions in his Diary, that he once had so slender an audience in his theatre called the *Fortune*, that the whole receipts of the house amounted to no more than three pounds and some odd shillings.

"Thus scanty and meagre were the apparatus and accommodations of our ancient theatres, on which those dramas were first exhibited, that have since engaged the attention of so many learned men, and delighted so many thousand spectators. Yet even then, we are told by a writer of that age, 'that dramatic poesy was so lively expressed and represented on the public stages and theatres of this city, as Rome in the age of her pomp and glory never saw it better performed; in respect of the action and art, not of the cost and sumptuousness."

PLEA, in *Law*, is what either party alleges for himself in court, in a cause there depending; and in a more restrained sense, it is the defendant's answer to the plaintiff's declaration.

Pleas are usually divided into those of the crown and common pleas. Pleas of the crown are all suits in the king's name, or in the name of the attorney-general in behalf of the king, for offences committed against his crown and dignity, and against his peace; as treason, murder, felony, &c. See ARRAIGNMENT.

Blackst. Comment.

Common pleas are such suits as are carried on between common persons in civil cases. These pleas are of two sorts; *dilatory* pleas, and pleas *to the action*. Dilatory pleas are such as tend merely to delay or put off the suit, by questioning the propriety of the remedy, rather than by denying the injury: pleas to the action are such as dispute the very cause of suit.

I. *Dilatory* pleas are, 1. To the jurisdiction of the court: alleging, that it ought not to hold plea of this injury, it arising in Wales or beyond sea: or because the land in question is of ancient demesne, and ought only to be demanded in the lord's court, &c. 2. To the disability of the plaintiff, by reason whereof he is incapable to commence or continue the suit; as, that he is an alien enemy, outlawed, excommunicated, attainted of treason or felony, under a præmunire, not *in rerum natura* (being only a fictitious person), an infant, a feme-covert, or a monk professed. 3. In abatement: which abatement is either of the writ, or the count, for some defect in one of them; as by misnaming the defendant, which is called a *misnomer;* giving him a wrong addition, as esquire instead of knight; or other want of form in any material respect. Or, it may be that the plaintiff is dead; for the death of either party is at once an abatement of the suit.

These pleas to the jurisdiction, to the disability, or in abatement, were formerly very often used as mere dilatory pleas, without any foundation in truth, and calculated only for delay; but now by stat. 4 & 5 Ann. c. 16. no dilatory plea is to be admitted without affidavit made of the truth thereof, or some probable matter shown to the court to induce them to believe it true. And with respect to the pleas themselves, it is a rule, that no exception shall be admitted against a declaration or writ, unless the defendant will in the same plea give the plaintiff a better; that is, show him how it might be amended, that there may not be two objections upon the same account.

All pleas to the jurisdiction conclude to the cognizance of the court; praying "judgment whether the court will have farther cognizance of the suit." Pleas to the disability conclude to the person; by praying "judgment, if the said A the plaintiff ought to be answered." And pleas in abatement (when the suit is by original) conclude to the writ, or declaration; by praying "judgment of the writ, or declaration, and that the same may be quashed," *cassetur*, made void, or abated: but if the action be by bill, the plea must pray "judgment of the bill," and not of the declaration; the bill being here the original, and the declaration only a copy of the bill.

When these dilatory pleas are allowed, the cause is either dismissed from that jurisdiction, or the plaintiff is stayed till his disability be removed; or he is obliged to sue out a new writ, by leave obtained from the court, or to amend and new-frame his declaration. But when, on the other hand, they are overruled as frivolous, the defendant has judgment of *respondeat ouster*, or to answer over in some better manner. It is then incumbent on him to plead,

2. A plea *to the action;* that is, to answer to the merits of the complaint. This is done by confessing or denying it.

A confession of the whole complaint is not very usual; for then the defendant would probably end the matter sooner, or not plead at all, but suffer judgment to go by default. Yet sometimes, after tender and refusal of a debt, if the creditor harasses his debtor with an action, it then becomes necessary for the defendant to acknowledge the debt, and plead the tender; adding, that he has always been ready, *tout temps prist*, and is still ready, *uncore prist*, to discharge it: for a tender by the debtor and refusal by the creditor will in all cases discharge the costs, but not the debt itself; though in some particular cases the creditor will totally lose his money. But frequently the defendant confesses one part of the complaint (by a *cognovit actionem* in respect thereof), and traverses or denies the rest; in order to avoid the expense of carrying that part to a formal trial, which he has no ground to litigate. A species of this sort of confession is the *payment of money into court:* which is for the most part necessary upon pleading a tender, and is itself a kind of tender to the plaintiff; by paying into the hands of the proper officer of the court as much as the defendant acknowledges to be due, together with the costs hitherto incurred, in order to prevent the expence of any farther proceedings. This may be done upon what is called a *motion;* which is an occasional application to the court by the parties or their counsel, in order to obtain some rule or order of court, which becomes necessary in the progress of a cause: and it is usually grounded upon an *affidavit* (the perfect tense of the verb *affido*), being a voluntary oath before some judge or officer of the court, to evince the truth of certain facts, upon which the motion is grounded: though no such affidavit is necessary for payment of money into court. If, after the money is paid in, the plaintiff proceeds in his suit, it is at his own peril: for if he does not prove more due than is so paid into court, he shall be nonsuited and pay the defendant's costs; but he shall still have the money so paid in, for that the defendant has acknowledged to be his due. To this head may also be referred the practice of what is called a *set off;* whereby the defendant acknowledges the justice of the plaintiff's demand on the one hand; but on the other, sets up a demand of his own, to counterbalance that of the plaintiff, either in the whole or in part; as, if the plaintiff sues for ten pounds due on a note of hand, the defendant may set off nine pounds due to himself for merchandise sold to the plaintiff; and, in case he plead such set-off, must pay the remaining balance into court.

Pleas that totally deny the cause of complaint, are either the general issue, or a special plea in bar.

1. The *general issue*, or general plea, is what traverses, thwarts, and denies at once, the whole declaration, without offering any special matter whereby to evade it. As in trespass either *vi et armis*, or on the case, "*non culpabilis*, not guilty;" in debt upon contract, "*nihil debet*, he owes nothing;" in debt on bond, "*non est factum*, it is not his deed;" on an *assumpsit*, "*non assumpsit*, he made no such promise." Or in real actions, "*nul tort*, no wrong done; *nul disseisin*, no disseisin;" and in a writ of right, the mise or issue is, that "the tenant has more right to hold than the demandant has to demand." These pleas are called the *general issue*, because, by importing an absolute and general denial of what is alleged in the declaration, they amount at once to an issue; by which we mean a fact affirmed on one side and denied on the other.

2. *Special* pleas in bar of the plaintiff's demands are very various, according to the circumstances of the defendant's case. As, in real actions, a general release or a fine; both of which may destroy and bar the plaintiff's title. Or, in personal actions, an accord, arbitration, conditions performed, nonage of the defendant, or some other fact which precludes the plaintiff from his action. A *justification* is likewise a special plea in bar; as in actions of assault and battery, *son assault demesne*, that it was the plaintiff's own original assault; in trespass, that the defendant did the thing complained of in right of some office which warranted him so to do; or, in an action of slander, that the plaintiff is really as bad a man as the defendant said he was.

Also a man may plead the statutes of limitation in bar; or the time limited by certain acts of parliament, beyond which no plaintiff can lay his cause of action. This, by the statute of 32 Hen. VIII. c. 2. in a writ of right is 60 years: in assizes, writs of entry, or other possessory actions real, of the seisin of one's ancestors in lands; and either of their seisin, or one's own, in rents, suits, and services, 50 years: and in actions real for lands grounded upon one's own seisin or possession, such possession must have been within 30 years. By statute 1 Mar. st. 2. c. 5. this limitation does not extend to any suit for avowsons. But by the statute 21 Jac. I. c. 2. a time of limitation was extended to the case of the king; viz. 60 years precedent to 19th Feb. 1623; but, this becoming ineffectual by efflux of time, the same date of limitation was fixed by statute 9 Geo. III. c. 16. to commence and be reckoned backwards, from the time of bringing any suit or other process to recover the thing in question; so that a possession for 60 years is now a bar even against the prerogative, in derogation of the ancient maxim, *Nullum tempus occurrit regi.* By another statute, 21 Jac. I. c. 16, 20 years is the time of limitation in any writ of formedon: and, by a consequence, 20 years is also the limitation in every action of ejectment; for no ejectment can be brought, unless where the lessor of the plaintiff is entitled to enter on the lands, and by the statute 21 Jac. I. c. 16. no entry can be made by any man, unless within 20 years after his right shall accrue. Also all actions of trespass (*quare clausum fregit*, or otherwise), detinue, trover, replevin, account, and case (except upon accounts between merchants), debt on simple contract, or for arrears of rent, are limited by the statute last mentioned to six years after the cause of action commenced: and actions of assault, menace, battery, mayhem, and imprisonment, must be brought within four years, and actions for words two years, after the injury committed. And by the statute 31 Eliz. c. 5. all suits, indictments, and informations, upon any penal statutes, where any forfeiture is to the crown, shall be sued within two years, and where the forfeiture is to a subject, within one year, after the offence committed,' unless where any other time is specially limited by the statute. Lastly, by statute 10 W. III. c. 14. no writ of error, *scire facias*, or other suit, shall be brought to reverse any judgement, fine, or recovery, for error, unless it be prosecuted within 20 years. The use of these statutes of limitation is to preserve the peace of the kingdom, and to prevent those innumerable perjuries which might ensue if a man were allowed to bring an action for any injury committed at any distance of time. Upon both these accounts the law therefore holds, that *interest reipublicæ ut sit finis litium*: and upon the same principle the Athenian laws in general prohibited all actions where the injury was committed five years before the complaint was made. If, therefore, in any suit, the injury, or cause of action, happened earlier than the period expressly limited by law, the defendant may plead the statutes of limitations in bar: as upon an *assumpsit*, or promise to pay money to the plaintiff, the defendant may plead, *Non assumpsit infra sex annos*, He made no such promise within six years; which is an effectual bar to the complaint.

An *estoppel* is likewise a special plea in bar; which happens where a man hath done some act, or executed some deed, which estops or precludes him from averring any thing to the contrary. As if a tenant for years (who hath no freehold) levies a fine to another person. Though this is void as to strangers, yet it shall work as an estoppel to the cognizor; for, if he afterwards brings an action to recover these lands, and his fine is pleaded against him, he shall thereby be estopped from saying, that he had no freehold at the time, and therefore was incapable of levying it.

The conditions and qualities of a plea (which, as well as the doctrine of estoppels, will also hold equally, *mutatis mutandis*, with regard to other parts of pleading), are, 1. That it be single and containing only one matter; for duplicity begets confusion. But by statute 4 and 5 Ann. c. 16. a man, with leave of the court, may plead two or more distinct matters or single pleas; as in an action of assault and battery, these three, Not guilty, *son assault demesne*, and the statute of limitations. 2. That it be direct and positive, and not argumentative. 3. That it have convenient certainty of time, place, and persons. 4. That it answer the plaintiff's allegations in every material point. 5. That it be so pleaded as to be capable of trial.

Special pleas are usually in the affirmative, sometimes in the negative, but they always advance some new fact not mentioned in the declaration; and then they must be averred to be true in the common form:—"And this he is ready to verify."—This is not necessary in pleas of the general issue, those always containing a total denial of the facts before advanced by the other party, and therefore putting him upon the proof of them. See PLEADINGS.

Blackst. Comment.

PLEA to Indictment, the defensive matter alleged by a criminal on his indictment; (see ARRAIGNMENT). This is either, 1. A plea to the jurisdiction; 2. A demurrer; 3. A plea in abatement; 4. A special plea in bar; or, 5. The general issue.

I. A plea to the *jurisdiction*, is where an indictment is taken before a court that hath no cognizance of the offence; as if a man be indicted for a rape at the sheriff's tourn, or for treason at the quarter-sessions: in these or similar cases, he may except to the jurisdiction of the court, without answering at all to the crime alleged.

II. A *demurrer* to the indictment, is incident to criminal cases, as well as civil, when the fact as alleged is allowed to be true, but the prisoner joins issue upon some point of law in the indictment, by which he insists, that the fact, as stated, is no felony, treason, or whatever the crime is alleged to be. Thus, for instance, if a man be indicted for feloniously stealing a greyhound; which is an animal in which no valuable property can be had, and therefore it is not felony, but only a civil trespass to steal it; in this case the party indicted may demur to the indictment; denying it to be felony, though he confesses the act of taking it. Some have held, that if, on demurrer, the point of law be adjudged against the prisoner, he shall have judgment and execution, as if convicted by verdict. But this is denied by others, who hold, that in such case he shall be directed and received to plead the general issue, Not guilty, after a demurrer determined against him. Which appears the more reasonable, because it is clear, that if the prisoner freely discovers the fact in court, and refers it to the opinion of the court whether it be felony or no; and upon the fact thus shown, it appears to be felony, the court will not record the confession, but admit him afterwards to plead not guilty. And this seems to be a case of the same nature, being for the most part a mistake in point of law, and in the conduct of his pleading; and, though a man by mispleading may in some cases lose his property, yet the law will not suffer him by such niceties to lose his life. However, upon this doubt, demurrers to indictments are seldom used; since the same advantages may be taken upon a plea of not guilty; or afterwards, in arrest of judgment, when the verdict has established the fact.

III. A plea in *abatement* is principally for a *misnomer*, a wrong name, or a false addition to the prisoner. As, if James Allen, gentleman, is indicted by the name of *John Allen, esquire*, he may plead that he has the name of *James*, and not of *John*; and that he is a *gentleman*, and not an *esquire*. And, if either fact is found by a jury, then the indictment shall be abated, as writs or declarations may be in civil actions. But, in the end, there is little advantage accruing to the prisoner by means of these dilatory pleas; because, if the exception be allowed, a new bill of indictment may be framed, according to what the prisoner in his plea avers to be his true name and addition. For it is a rule, upon all pleas in abatement, that he who takes advantage of a flaw, must at the same time show how it may be amended. Let us, therefore, next consider a more substantial kind of plea, &c.

IV. Special pleas in *bars;* which go to the merits of the indictment, and give a reason why the prisoner ought not to answer it at all, nor put himself upon his trial for the crime alleged. These are of four kinds: a former acquittal, a former conviction, a former attainder, or a pardon. There are many other pleas which may be pleaded in bar of an appeal: but these are applicable to both appeals and indictments.

1. First, the plea of *auterfoits acquit*, or a former acquittal, is grounded on this universal maxim of the common law of England, that no man is to be brought into jeopardy of his life, more than once, for the same offence. And hence it is allowed as a consequence, that when a man is once fairly found not guilty upon any indictment, or other prosecution, before any court having competent jurisdiction of the offence, he may plead such acquittal in bar of any subsequent accusation for the same crime.

2. Secondly, the plea of *auterfoits convict*, or a former conviction for the same identical crime, though no judgment was ever given, or perhaps will be (being suspended by the benefit of clergy or other causes), is a good plea in bar to an indictment. And this depends upon the same principle as the former, that no man ought to be twice brought in danger of his life for one and the same crime.

3. Thirdly, the plea of *auterfoits attaint*, or a former attainder, is a good plea in bar, whether it be for the same or any other felony. For wherever a man is attainted of felony, by judgment of death either upon a verdict or confession, by outlawry, or heretofore by abjuration, and whether upon an appeal or an indictment; he may plead such attainder in bar to any subsequent indictment or appeal, for the same or for any other felony. And this because, generally, such proceeding on a second prosecution cannot be to any purpose; for the prisoner is dead in law by the first attainder, his blood is already corrupted, and he hath forfeited all that he had: so that it is absurd and superfluous to endeavour to attaint him a second time. Though to this general rule, as to all others, there are some exceptions; wherein, *cessante ratione, cessant et ipsa lex.*

4. Lastly, a pardon may be pleaded in bar; as at once destroying the end and purpose of the indictment, by remitting that punishment, which the prosecution is calculated to inflict. There is one advantage that attends pleading a pardon in bar, or in the arrest of judgment before sentence is past; which gives it by much the preference to pleading it after sentence or attainder. This is, that by stopping the judgment it stops the attainder, and prevents the corruption of the blood: which, when once corrupted by attainder, cannot afterwards be restored otherwise than by act of parliament.

V. The *general issue*, or plea of not guilty, upon which plea alone the prisoner can receive his final judgment of death. In case of an indictment of felony or treason, there can be no special justification put in by way of plea. As, on an indictment for murder, a man cannot plead that it was in his own defence against a robber on the highway, or a burglar; but he must plead the general issue, Not guilty, and give this special matter in evidence. For (besides that these pleas do in effect amount to the general issue; since, if true, the prisoner is most clearly not guilty) as the facts in treason are laid to be done *proditoriè et contra ligeantiæ suæ debitum;* and, in felony, that the killing was done *felonicè;* these charges, of a traiterous or felonious intent, are the points and very *gist* of the indictment, and must be answered directly, by the general negative, Not guilty; and the jury upon the evidence will take notice of any defensive matter, and give their verdict accordingly as effectually as if it were or could be specially pleaded. So that this is, upon all accounts, the most advantageous plea for the prisoner.

When the prisoner hath thus pleaded not guilty, *non culpabilis*, or *nient culpable:* which was formerly used to be abbreviated upon the minutes, thus, *Non* (or *nient*) *cul.* the clerk of the assize, or clerk of arraigns, on behalf of the crown, replies, that the prisoner is guilty, and that he is ready to prove him so. This is done by two monosyllables in the same spirit of abbreviation, (*cul. prit*): which signifies first that the prisoner is guilty, (*cul. culpable*, or *culpabilis*); and then that the king is ready to prove him so, (*prit, præsto sum*, or *paratus verificare*). By this replication the king and the prisoner are therefore at issue: for when the parties come to a fact which is affirmed on one side and denied on the other, then they are said to be at issue in point of fact: which is evidently the case here, in the plea of *non cul.* by the prisoner; and the replication of *cul.* by the clerk.

How the courts came to express a matter of this importance in so odd and obscure a manner, can hardly be pronounced with certainty. It may perhaps, however, be accounted for by supposing, that these were at first short notes, to help the memory of the clerk, and remind him what he was to reply; or else it was the short method of taking down in court, upon the minutes, the replication and averment; *cul. prit.:* which afterwards the ignorance of succeeding clerks adopted for the very words to be by them spoken (A).

But however it may have arisen, the joining of issue seems to be clearly the meaning of this obscure expression; which has puzzled our most ingenious etymologists, and is commonly understood as if the clerk of the arraigns, immediately on plea pleaded, had fixed an opprobrious name on the prisoner, by asking him, "*culprit*, how wilt thou be tried?" for immediately upon issue joined it is inquired of the prisoner, by what trial he will make his innocence appear. This form has at present reference to appeals and approvements only, wherein the appellee has his choice, either to try the accusation by

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(A) Of this ignorance we may see daily instances, in the abuse of two legal terms of ancient French: one the prologue to all proclamations, "*Oyez*, or Hear ye," which is generally pronounced, most unmeaningly, "O yes:" the other, a more pardonable mistake, viz. when a jury are all sworn, the officer bids the crier number them, for which the word in law-French is, "*Countez;*" but we now hear it pronounced in very good English, "Count these."

BATTLE or by JURY. But upon indictments, since the abolition of ORDEAL, there can be no other trial but by jury, *per pais*, or by the country: and therefore, if the prisoner refuses to put himself upon the inquest in the usual form, that is, to answer that he will be tried by God and the country, if a commoner; and, if a peer, by God and his peers; the indictment, if in treason, is taken *pro confesso;* and the prisoner, in cases of felony, is judged to stand mute, and, if he perseveres in his obstinacy, shall now be convicted of the felony.

When the prisoner has thus put himself upon his trial, the clerk answers in the humane language of the law, which always hopes that the party's innocence rather than his guilt may appear, "God send thee a good deliverance." And then they proceed, as soon as conveniently may be, to the trial. See the article TRIAL.

PLEADINGS, in *Law*, are the mutual altercations between the plaintiff and defendant, (see SUIT, WRIT, and PROCESS). They form the third part or stage of a fact; and at present are set down and delivered into the proper office in writing, though formerly they were usually put in by their counsel *ore tenus*, or *viva voce*, in court, and then minuted down by the chief clerks or prothonotaries; whence, in our old law-French, the pleadings are frequently denominated the *parol*.

The first of these is the *declaration*, *narratio*, or *count*, anciently called the *tale;* in which the plaintiff sets forth his cause of complaint at length: being indeed only an amplification or exposition of the original writ upon which his action is founded, with the additional circumstances of time and place, when and where, the injury was committed.

In *local* actions, where possession of land is to be recovered, or damages for an actual trespass, or for waste, &c. affecting land, the plaintiff must lay his declaration, or declare his injury to have happened in the very county and place that it really did happen; but in *transitory* actions, for injuries that might have happened anywhere, as debt, detinue, slander, and the like, the plaintiff may declare in what county he pleases, and then the trial must be in that county in which the declaration is laid. Though, if the defendant will make affidavit that the cause of action, if any, arose not in that but another county, the court will direct a change of *the venue* or *visne* (that is, the *vicinia* or neighbourhood in which the injury is declared to be done), and will oblige the plaintiff to declare in the proper county. For the statute 6 Ric. II. c. 2. having ordered all writs to be laid in their proper counties, this, as the judges conceived, impowered them to change the *venue*, if required, and not to insist rigidly on abating the writ: which practice began in the reign of James I. And this power is discretionally exercised, so as not to cause but prevent a defect of justice. Therefore the court will not change the *venue* to any of the four northern counties previous to the spring circuit; because there the assises are holden only once a-year, at the time of summer circuit. And it will sometimes remove the *venue* from the proper jurisdiction (especially of the narrow and limited kind), upon a suggestion, duly supported, that a fair and impartial trial cannot be had therein.

It is generally usual, in actions upon the case, to set forth several cases, by different counts in the same declaration; so that if the plaintiff fails in the proofs of one, he may succeed in another. As in an action on the case upon an ASSUMPSIT for goods sold and delivered, the plaintiff usually counts or declares, first, upon a settled and agreed price between him and the defendant; as that they bargained for 20l.: and lest he should fail in the proof of this, he counts likewise upon a *quantum valebant;* that the defendant bought other goods, and agreed to pay him so much as they were reasonably worth: and then avers that they were worth other 20l. and so on in three or four different shapes; and at last concludes with declaring, that the defendant had refused to fulfil any of these agreements, whereby he is endamaged to such a value. And if he proves the case laid in any one of his counts, though he fails in the rest, he shall recover proportionable damages. This declaration always concludes with these words, "and thereupon he brings suit," &c. *inde producit sectam*, &c. By which words, *suit* or *secta* (*à sequendo*), were anciently understood the witnesses or followers of the plaintiff. For in former times, the law would not put the defendant to the trouble of answering the charge till the plaintiff had made out at least a probable case. But the actual production of the *suit*, *secta*, or *followers*, is now antiquated, and hath been totally disused, at least ever since the reign of Edward III. though the form of it still continues.

At the end of the declaration are added also the plaintiff's common pledges of prosecution, John Doe and Richard Roe; which, as we elsewhere observe, (see WRIT), are now mere names of form; though formerly they were of use to answer to the king for the amercement of the plaintiff, in case he were nonsuited, barred of his action, or had a verdict and judgment against him. For if the plaintiff neglects to deliver a declaration for two terms after the defendant appears, or is guilty of other delays or defaults against the rules of law in any subsequent stage of the action, he is adjudged not to follow or pursue his remedy as he ought to do; and thereupon a *nonsuit*, or *non prosequitur*, is entered, and he is said to be *non-pros*'d. And for thus deserting his complaint, after making a false claim or complaint (*pro falso clamore suo*), he shall not only pay costs to the defendant, but is liable to be amerced to the king. A *retraxit* differs from a nonsuit, in that the one is negative and the other positive: the nonsuit is a default and neglect of the plaintiff, and therefore he is allowed to begin his suit again upon payment of costs; but a *retraxit* is an open and voluntary renunciation of his suit in court; and by this he for ever loses his action. A *discontinuance* is somewhat similar to a nonsuit; for when a plaintiff leaves a chasm in the proceedings of his cause, as by not continuing the process regularly from day to day, and time to time, as he ought to do, the suit is discontinued, and the defendant is no longer bound to attend; but the plaintiff must begin again, by suing out a new original, usually paying costs to his antagonist.

When the plaintiff hath stated his case in the declaration, it is incumbent on the defendant, within a reasonable time, to make his defence, and put in a plea; or else the plaintiff will at once recover judgment by *default*, or *nihil dicit*, of the defendant.

Defence, in its true legal sense, signifies not a justification, protection, or guard, which is now its popular signification; but merely an *opposing* or *denial* (from the French verb *defendre*) of the truth or validity of the complaint. It is the *contestatio litis* of the civilians: a general assertion that the plaintiff hath no ground of action; which assertion is afterwards extended and maintained in his plea.

Before defence made, if at all, cognizance of the suit must be claimed or demanded; when any person or body-corporate hath the franchise, not only of holding pleas within a particular limited jurisdiction, but also of the cognizance of pleas; and that either without any words exclusive of other courts, which intitles the lord of the franchise, whenever any suit that belongs to his jurisdiction is commenced in the courts at Westminster, to demand the cognizance thereof; or with such exclusive words, which also intitle the defendant to plead to the jurisdiction of the court. Upon this claim of cognizance, if allowed, all proceedings shall cease in the superior court, and the plaintiff is left at liberty to pursue his remedy in the special jurisdiction. As, when a scholar or other privileged person of the universities of Oxford or Cambridge is impleaded in the courts at Westminster, for any cause of action whatsoever, unless upon a question of freehold. In these cases, by the charter of those learned bodies, confirmed by act of parliament, the chancellor, or vice-chancellor, may put in a claim of cognizance; which, if made in due time and form, and with due proof of the facts alleged, is regularly allowed by the courts. It must be demanded before full defence is made or imparlance prayed; for these are a submission to the jurisdiction of the superior court, and the delay is a *laches* in the lord of the franchise: and it will not be allowed if it occasions a failure of justice, or if an action be brought against the person himself who claims the franchise, unless he hath also a power in such case of making another judge.

After defence made, the defendant must put in his plea. But before he defends, if the suit is commenced by *capias* or *latitat*, without any special original, he is intitled to demand one *imparlance*, or *licentia loquendi;* and may, before he pleads, have more granted by consent of the court, to see if he can end the matter amicably without farther suit, by talking with the plaintiff: a practice which is supposed to have arisen from a principle of religion, in obedience to that precept of the gospel, "agree with thine adversary quickly, whilst thou art *in the way* with him." And it may be observed, that this gospel-precept has a plain reference to the Roman law of the twelve tables, which expressly directed the plaintiff and defendant to make up the matter while they were in the way, or going to the prætor;—*in via, rem uti pacent orato.* There are also many other previous steps which may be taken by a defendant before he puts in his plea. He may, in real actions, demand a view of the thing in question, in order to ascertain its identity and other circumstances. He may crave *oyer* of the writ, or of the bond, or other specialty upon which the action is brought: that is, to hear it read to him; the generality of defendants in the times of ancient simplicity being supposed incapable to read it themselves: whereupon the whole is entered *verbatim* upon the record; and the defendant may take advantage of any condition, or other part of it, not stated in the plaintiff's declaration. In real actions also the tenant may pray in *aid*, or call for the assistance of another, to help him to plead, because of the feebleness or imbecility of his own estate. Thus a tenant for life may pray in aid of him that hath the inheritance in remainder or reversion; and an incumbent may pray in aid of the patron and ordinary; that is, that they shall be joined in the action, and help to defend the title. *Voucher* also is the calling in of some person to answer the action, that hath warranted the title to the tenant or defendant. This we still make use of in the form of common recoveries, which are grounded on a writ of entry; a species of action that relies chiefly on the weakness of the tenant's title, who therefore vouches another person to warrant it. If the voucher appear, he is made defendant instead of the voucher; but if he afterwards makes default, recovery shall be had against the original defendant; and he shall recover an equivalent in value against the deficient vouchee. In assizes, indeed, where the principal question is, whether the demandant or his ancestors were or were not in possession till the ouster happened, and the title of the tenant is little (if at all) discussed, there no voucher is allowed; but the tenant may bring a writ of *warrantia chartæ* against the warrantor, to compel him to assist him with a good plea or defence, or else to render damages and the value of the land, if recovered against the tenant. In many real actions also, brought by or against an infant under the age of 21 years, and also in actions of debt brought against him, as heir to any deceased ancestor, either party may suggest the nonage of the infant, and pray that the proceedings may be deferred till his full age, or, in our legal phrase, that the infant may have his age, and that the *parol may demur*, that is, that the pleadings may be staid; and then they shall not proceed till his full age, unless it be apparent that he cannot be prejudiced thereby. But by the statutes of Westm. 1. 3 Edw. I. c. 46. and of Glocester, 6 Edw. I. c. 2. in writs of entry, *sur disseisin* in some particular cases, and in actions auncestrel brought by an infant, the parol shall not demur; otherwise he might be deforced of his whole property, and even want a maintenance, till he came of age. So likewise in a writ of dower the heir shall not have his age; for it is necessary that the widow's claim be immediately determined, else she may want a present subsistence. Nor shall an infant patron have it in a *quare impedit*, since the law holds it necessary and expedient that the church be immediately filled.

When these proceedings are over, the defendant must then put in his excuse or plea. See PLEA.

It is a rule in pleading, that no man be allowed to plead especially such a plea as amounts only to the general issue, or a total denial of the charge; but in such case he shall be driven to plead the general issue in terms, whereby the whole question is referred to a jury. But if the defendant, in an assize or action of trespass, be desirous to refer the validity of his title to the court rather than the jury, he may state his title specially; and at the same time give colour to the plaintiff, or suppose him to have an appearance or colour of title, bad indeed in point of law, but of which the jury are not competent judges. As if his own true title is, that he claims by feoffment with livery from A, by force of which he entered on the lands in question, he cannot plead this by itself, as it amounts to no more than the general issue, *nul tort, nul disseisin*, in assize, or *not guilty* in an action of trespass. But he may allege this specially, provided he goes farther, and says, that the plaintiff claiming by colour of a prior deed of feoffment, without

out livery, entered; upon whom he entered; and may then refer himself to the judgment of the court which of these two titles is the best in point of law.

When the plea of the defendant is thus put in, if it does not amount to an issue or total contradiction of the declaration, but only evades it, the plaintiff may plead again, and reply to the defendant's plea: Either traversing it, that is, totally denying it; as if, on an action of debt upon bond, the defendant pleads *solvit ad diem*, that he paid the money when due; here the plaintiff in his replication may totally traverse this plea, by denying that the defendant paid it: Or he may allege new matter in contradiction to the defendant's plea; as when the defendant pleads no award made, the plaintiff may reply, and set forth an actual award, and assign a breach: Or the replication may confess and avoid the plea by some new matter or distinction, consistent with the plaintiff's former declaration; as in an action for trespassing upon land whereof the plaintiff is seized, if the defendant shows a title to the land by descent, and that therefore he had a right to enter, and gives colour to the plaintiff, the plaintiff may either traverse and totally deny the fact of the descent; or he may confess and avoid it, by replying, that true it is that such descent happened, but that since the descent the defendant himself demised the lands to the plaintiff for term of life. To the replication the defendant may *rejoin*, or put in an answer called a *rejoinder*. The plaintiff may answer the rejoinder by a *sur-rejoinder;* upon which the defendant may *rebut*, and the plaintiff answer him by a *sur-rebutter*. Which pleas, replications, rejoinders, fur-rejoinders, rebutters, and sur-rebutters, answer to the *exceptio*, *replicatio*, *duplicatio*, *triplicatio*, and *quadruplicatio*, of the Roman laws.

The whole of this process is denominated the *pleading;* in the several stages of which it must be carefully observed, not to depart or vary from the title or defence which the party has once insisted on. For this (which is called a *departure* in pleading) might occasion endless altercation. Therefore the replication must support the declaration, and the rejoinder must support the plea, without departing out of it. As in the case of pleading no award made in consequence of a bond of arbitration, to which the plaintiff replies, setting forth an actual award; now the defendant cannot rejoin that he hath performed this award, for such rejoinder would be an entire departure from his original plea, which alleged that no such award was made: therefore he has now no other choice, but to traverse the fact of the replication, or else to demur upon the law of it.

Again, all duplicity in pleading must be avoided. Every plea must be simple, entire, connected, and confined to one single point: it must never be entangled with a variety of distinct independent answers to the same matter; which must require as many different replies, and introduce a multitude of issues upon one and the same dispute. For this would often embarrass the jury, and sometimes the court itself, and at all events would greatly enhance the expence of the parties. Yet it frequently is expedient to plead in such a manner as to avoid any implied admission of a fact, which cannot with propriety or safety be positively affirmed or denied. And this may be done by what is called a *protestation;* whereby the party interposes an oblique allegation or denial of some fact, protesting (by the gerund, *protestando*) that such a matter does or does not exist; and at the same time avoiding a direct affirmation or denial. Sir Edward Coke hath defined a protestation (in the pithy dialect of that age) to be, "an exclusion of a conclusion." For the use of it is, to save the party from being concluded with respect to some fact or circumstance which cannot be directly affirmed or denied without falling into duplicity of pleading; and which yet, if he did not thus enter his protest, he might be deemed to have tacitly waved or admitted. Thus, while tenure in villainage, subsisted, if a villain had brought an action against his lord, and the lord was inclined to try the merits of the demand, and at the same time to prevent any conclusion against himself that he had waved his signiory; he could not in this case both plead affirmatively that the plaintiff was his villain, and also take issue upon the demand; for then his plea would have been double, as the former alone would have been a good bar to the action: but he might have alleged the villainage of the plaintiff by way of protestation, and then have denied the demand. By this means the future vassalage of the plaintiff was saved to the defendant, in case the issue was found in his (the defendant's) favour; for the protestation prevented that conclusion which would otherwise have resulted from the rest of his defence, that he had enfranchised the plaintiff, since no villain could maintain a civil action against his lord. So also if a defendant, by way of inducement to the point of his defence, alleges (among other matters) a particular mode of seisin or tenure which the plaintiff is unwilling to admit, and yet desires to take issue on the principal point of the defence, he must deny the seisin or tenure by way of protestation, and then traverse the defensive matter. So, lastly, if an award be set forth by the plaintiff, and he can assign a breach in one part of it (viz. the non payment of a sum of money), and yet is afraid to admit the performance of the rest of the award, or to aver in general a non-performance of any part of it, lest something should appear to have been performed; he may save to himself any advantage he might hereafter make of the general non-performance, by alleging that by protestation, he can plead only the nonpayment of the money.

In any stage of the pleadings, when either side advances or affirms any new matter, he usually (as was said) avers it to be true; "and this he is ready to verify." On the other hand, when either side traverses or denies the facts pleaded by his antagonist, he usually tenders an *issue*, as it is called; the language of which is different according to the party by whom it is tendered: for if the traverse or denial comes from the defendant, the issue is tendered in this manner, "And of this he puts himself upon the country," thereby submitting himself to the judgment of his peers: but if the traverse lies upon the plaintiff, he tenders the issue or prays the judgment of the peers against the defendant in another form; thus, "and this he prays may be inquired of by the country."

But if either side (as, for instance, the defendant) pleads a special negative plea, not traversing or denying any thing that was before alleged, but disclosing some new negative matter; as where the suit is on a bond conditioned to perform an award, and the defendant pleads negatively, that no award was made; he tenders no issue upon this plea, because it does not yet appear whether the fact will be disputed, the plaintiff not having yet asserted the existence of any award: but when the plaintiff replies, and sets forth an actual specific award, if then the defendant traverses the replication, and denies the making of any such award, he then, and not before, tenders an issue to the plaintiff. For when in the course of pleading they come to a point which is affirmed on one side and denied on the other, they are then said to be at issue; all their debates being at last contracted into a single point, which must now be determined either in favour of the plaintiff or of the defendant. See ISSUE.

PLEASING, art of. See POLITENESS.

PLEASURE is a word so universally understood as to need no explanation. Lexicographers, however, who must attempt to explain every word, call it "the gratification of the mind or senses." It is directly opposite to PAIN, and constitutes the whole of positive happiness, as that does of misery.

The Author of Nature has furnished us with many pleasures, as well as made us liable to many pains; and we are susceptible of both in some degree as soon as we have life and are endowed with the faculty of sensation. A French writer, in a work * which once raised high expectations, contends, that a child in the womb of its mother feels neither pleasure nor pain. "These sensations (says he) are not innate; they have their origin from without; and it is at the moment of our birth that the soul receives the first impressions; impressions slight and superficial at the beginning, but which by time and repeated acts leave deeper traces in the sensorium, and become more extensive and more lasting. It is when the child sends forth its first cries that sensibility or the faculty of sensation is produced, which in a short time gathers strength and stability by the impression of exterior objects. Pleasure and pain not being innate, and being only acquired in the same manner as the qualities which we derive from instruction, education, and society, it follows that we learn to suffer and enjoy as we learn any other science."

This is strange reasoning and strange language. That sensations are not innate is universally acknowledged; but it does not therefore follow that the soul receives its first impressions and first sensations at the moment of birth. The child has life, the power of locomotion, and the sense of touch, long before it is born; and every mother will tell this philosopher, that an infant unborn exhibits symptoms both of pain and of pleasure. That many of our organs of sense are improved by use is incontrovertible; but it is so far from being true that our sensible pleasures become more exquisite by being often repeated, that the direct contrary is experienced of far the greater part of them; and though external objects, by making repeated impressions on the senses, certainly leave deeper traces on the memory than an object once perceived can do, it by no means follows that these impressions become the more delightful the more familiar that they are to us. That we learn to suffer and enjoy as we learn any other science, is a most extravagant paradox; for it is self-evident that we cannot live without being capable in some degree both of suffering and enjoyment, though a man may certainly live to old age in profound ignorance of all the sciences.

The same writer assures us, indeed, that sensation is not necessary to human life. "Philosophers (says he) make mention of a man who had lost every kind of feeling in every member of his body: he was pinched or pricked to no purpose. Meanwhile this man made use of all his members; he walked without pain, he drank, ate, and slept, without perceiving that he did so. Sensible neither to pleasure nor pain, he was a true natural machine."

To the tale of these anonymous philosophers our author gives implicit credit, whilst he favours us at the same instant with the following argumentation, which completely proves its falsehood. "It is true that sensation is a relative quality, susceptible of increase and diminution; that it is not necessary to existence; and that one might live without it: but in this case he would live as an automaton, without feeling pleasure or pain; and he would possess neither idea, nor reflection, nor desire, nor passion, nor will, nor sentiment; his existence would be merely passive, he would live without knowing it, and die without apprehension."

But if this man of the philosophers, whom our author calls an *automaton*, and a *true natural machine*, had neither *idea*, nor *desire*, nor *passion*, nor *will*, nor *sentiment* (and without sensation he certainly could have none of them), what induced him to *walk*, *eat*, or *drink*, or to *cease* from any of these operations after they were accidentally begun? The instances of the *automata* which played on the flute and at chess are not to the purpose for which they are adduced; for there is no parallel between them and this natural machine, unless the philosophers wound up their man to eat, drink, walk, or sit, as Vacanson and Kempeler wound up their automata to play or cease from playing on the German flute and at chess. See ANDROIDES.

Our author having for a while sported with these harmless paradoxes, proceeds to put the credulity of his reader to the test with others of a very contrary tendency. He institutes an inquiry concerning the superiority, in number and degree, of the pleasures enjoyed by the different orders of men in society; and labours, not indeed by argument, but by loose declamation, to propagate the belief that happiness is very unequally distributed. The pleasures of the rich, he says, must be more numerous and exquisite than those of the poor; the nobleman must have more enjoyments than the plebeian of equal wealth; and the king, according to him, must be the happiest of all men. He owns, indeed, that although "birth, rank, honours, and dignity, add to happiness, a man is not to be considered as miserable because he is born in the lower conditions of life. A man may be happy as a mechanic, a merchant, or a labourer, provided he enters into the spirit of his profession, and has not imbibed by a misplaced education those sentiments which make his condition insupportable. Happiness is of easy acquisition in the middling stations of life; and though perhaps we are unable to know or to rate exactly the pleasure which arises from contentment and mediocrity, yet happiness being a kind of aggregate of delights, of riches, and of advantages more or less great, every person must have a share of it; the division is not exactly made, but all other things equal there will be more in the elevated than in the inferior conditions of society; the enjoyment will be more felt, the means of enjoying more multiplied, and the pleasures more varied. Birth, rank, fortune, talents, wit, genius, and virtue, are then the great sources of happiness: those advantages are so considerable, that we see men contented with any one of them; but their union forms supreme felicity.

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* *Encyclopedic Methodique, Logique, Metaphysique, et Morale*, tom. iv.

"There is so vast a difference, says Voltaire, between a man who has made his fortune and one who has to make it, that they are scarcely to be considered as creatures of the same kind. The same thing may be said of birth, the greatest of all advantages in a large society; of rank, of honours, and of great abilities. How great a difference is made between a person of high birth and a tradesman; between a Newton or Descartes and a simple mathematician? Ten thousand soldiers are killed on the field of battle, and it is scarcely mentioned; but if the general fall, and especially if he be a man of courage and abilities, the court and city are filled with the news of his death, and the mourning is universal.

"Frederick the Great, king of Prussia, felt in a more lively manner than perhaps any other man the value of great talents. I would willingly renounce, said he to Voltaire, every thing which is an object of desire and ambition to man; but I am certain if I were not a prince I should be nothing. Your merit alone would gain you the esteem, and envy, and admiration of the world; but to secure respect for me, titles, and armies, and revenues, are absolutely necessary."

For what purpose this account of human happiness was published, it becomes not us to say. Its obvious tendency is to make the lower orders of society discontented with their state, and envious of their superiors; and it is not unreasonable to suppose, that it contributed in some degree to excite the ignorant part of the author's countrymen to the commission of those atrocities of which they have since been guilty. That such was his intention, the following extract will not permit us to believe; for though in it the author attempts to support the same false theory of human happiness, he mentions virtuous kings with the respect becoming a loyal subject of the unfortunate Louis, whose character he seems to have intentionally drawn, and whose death by the authority of a savage faction he has in effect foretold.

"Happiness, in a state of society, takes the most variable forms: it is a Proteus susceptible of every kind of metamorphosis: it is different in different men, in different ages, and in different conditions, &c. The pleasures of youth are very different from those of old age: what affords enjoyment to a mechanic would be supreme misery to a nobleman: and the amusements of the country would appear insipid in the capital. Is there then nothing fixed with regard to happiness? Is it of all things the most variable and the most arbitrary? Or, in judging of it, is it impossible to find a standard by which we can determine the limits of the greatest good to which man can arrive in the present state? It is evident that men form the same ideas of the beautiful and sublime in nature, and of right and wrong in morality, provided they have arrived at that degree of improvement and civilization of which human nature is susceptible; and that different opinions on these subjects depend on different degrees of culture, of education, and of improvement. The same thing may be advanced with regard to happiness: all men, if equal with respect to their organs, would form the very same ideas on this subject if they reached the degree of improvement of which we are presently speaking; and in fact, do we not see in the great circles at Rome, at Vienna, at London, and at Paris, that those who are called people of fashion, who have received the same education, have nearly the same taste, the same desires, and the same spirit for enjoyment? there is doubtless a certain degree of happiness to be enjoyed in every condition of life; but as there are some conditions preferable to others, so are there degrees of happiness greater and less; and if we were to form an idea of the greatest possible in the present state, it perhaps would be that of a sovereign, master of a great empire, enjoying good health and a moderate spirit; endowed with piety and virtue; whose whole life was employed in acts of justice and mercy, and who governed by fixed and immoveable laws. Such a king is the image of the divinity on earth, and he must be the idol of a wise people. His whole life should present a picture of the most august felicity. Although such sovereigns are rare, yet we are not without examples of them. Ancient history affords us Titus and Marcus Aurelius, and the present age can boast of piety and munificence in the character of some of its kings. This state of the greatest happiness to which man can reach not being ideal, it will serve as a standard of comparison by which happiness and misery can be estimated in all civilized countries. *He is as happy as a king*, is a proverbial expression, because we believe with justice that royalty is the extreme limit of the greatest enjoyments; and in fact, happiness being the work of man, that condition which comprehends all the degrees of power and of glory, which is the source of honour and of dignity, and which supposes in the person invested with it all means of enjoyment either for himself or others, leaves nothing on this earth to which any reasonable man would give the preference.

"We can find also in this high rank the extreme of the greatest evils to which the condition of nature is exposed. A king condemned to death and perishing on a scaffold, by the authority of a faction, while at the same time he had endeavoured by every means in his power to promote the general happiness of his subjects, is the most terrible and striking example of human misery; for if it be true that a crown is the greatest of all blessings, then the loss of it, and at the same time the loss of life by an ignominious and unjust sentence, are of all calamities the most dreadful.

"It is also in the courts of kings that we find the most amiable and perfect characters; and it is there where true grandeur, true politeness, the best tone of manners, the most amiable graces, and the most eminent virtues, are completely established. It is in courts that men seem to have acquired their greatest improvement: Whosoever has seen a court, says La Bruyere, has seen the world in the most beautiful, the most enchanting, and attractive colours. The prejudices of mankind in behalf of the great are so excessive, that if they inclined to be good they would be almost the objects of adoration."

In this passage there are doubtless many just observations; but there is at least an equal number of others both false and dangerous. That a crown is the greatest of earthly blessings, and that it is in the courts of kings that we meet with the most amiable and perfect characters, are positions which a true philosopher will not admit but with great limitations. The falsehood of the author's general theory respecting the unequal distribution of happiness in society, we need not waste time in exposing. It is sufficiently exposed in other articles of this work, and in one of them by a writer of a very superior order (see HAPPINESS; and *MORAL Philosophy*, Part II. chap. ii.). He enters upon other speculations respecting the pleasures and pains of savages, which are ingenious and worthy of attention; but before we proceed to notice them, it will be proper to consider the connection which subsists between pleasure and pain.

"That the cessation of pain is accompanied by pleasure, is a fact (says a philosopher of the first rank †) which has been repeatedly observed, but perhaps not sufficiently accounted for. Let us suppose a person in a state of indifference as to heat. Upon coming near a fire, he will experience at first an agreeable warmth, i. e. pleasure. If the heat be increased, this state of pleasure will, after a time, be converted into one of pain, from the increased action upon the nerves and brain, the undoubted organs of all bodily sensations. Let the heat now be gradually withdrawn, the nervous system must acquire again, during this removal, the state of agreeable warmth or pleasure; and after passing through that state it will arrive at indifference. From this fact then we may conclude that a state of pleasure may be pushed on till it is converted into one of pain; and, on the other hand, that an action which produces pain will, if it go off gradually, induce at a certain period of its decrease a state of pleasure. The same reasoning which has thus been applied to the body may be extended also to the mind. Total languor of mind is not so pleasant as a certain degree of action or emotion; and emotions pleasant at one period may be increased till they become painful at another; whilst painful emotions, as they gradually expire, will, at a certain period of their decrease, induce a state of pleasure. Hence then we are able to explain why pleasure should arise in all cases from the gradual cessation of any action or emotion which produces pain."

The same author maintains, that from the mere removal of pain, whether by degrees or instantaneously, we always experience pleasure; and if the pain removed was exquisite, what he maintains is certainly true. To account for this phenomenon he lays down the following law of nature, which experience abundantly confirms, viz. "that the temporary withdrawing of any action from the body or mind invariably renders them more susceptible of that action when again produced." Thus, after long fasting, the body is more susceptible of the effects of food than if the stomach had been lately satisfied; the action of strong liquors is found to be greater on those who use them seldom than on such as are in the habit of drinking them. Thus, too, with respect to the mind; if a person be deprived for a time of his friend's society, or of a favourite amusement, the next visit of his friend, or the next renewal of his amusement, is attended with much more pleasure than if they had never been withheld from him.

"To apply this law to the case of a person suddenly relieved from acute pain. While he labours with such pain, his mind is so totally occupied by it, that he is unable to attend to his customary pursuits or amusements. He becomes therefore so much more susceptible of their action, that when they are again presented to him, he is raised above his usual indifference to positive pleasure. But all pains do not proceed from an excess of action. Many of them arise from reducing the body or the mind to a state below indifference. Thus, if a person have just sufficient warmth in his body to keep him barely at ease or in a state of indifference, by withdrawing this heat, a state of uneasiness or pain is produced; and if in a calm state of mind one be made acquainted with a melancholy event, his quiet is interrupted, and he sinks below indifference into a painful state of mind. If now, without communicating any new source of positive pleasure, we remove in the former case the cold, and in the latter the grief, the persons from whom they are removed will experience real pleasure. Thus, then, whether pain arises from excess or deficiency of action, the gradual or the sudden removal of it must be in all cases attended with pleasure *." It is equally true that the gradual or sudden removal of pleasure is attended with pain.

We are now prepared to examine our French author's account of the pleasures and pains of savages. "Every age (says he) has its different pleasures; but if we were to imagine that those of childhood are equal to those of confirmed age, we should be much mistaken in our estimation of happiness. The pleasures of philosophy, either natural or moral, are not unfolded to the infant; the most perfect music is a vain noise; the most exquisite perfumes and dishes highly seasoned offend his young organs instead of affording delight; his touch is imperfect; forty days elapse before the child gives any sign of laughter or of weeping; his cries and groans before that period are not accompanied with tears; his countenance expresses no passion; the parts of his face bear no relation to the sentiments of the soul, and are moreover without consistency. Children are but little affected with cold; whether it be that they feel less, or that the interior heat is greater than in adults. In them all the impressions of pleasure and pain are transitory; their memory has scarcely begun to unfold its powers; they enjoy nothing but the present moment; they weep, laugh, and give tones of satisfaction without consciousness, or at least without reflection; their joy is confined to the indulgence of their little whims, and constraint is the greatest of their misfortunes; few things amuse, and nothing satisfies them. In this happy condition of early infancy nature is at the whole expence of happiness; and the only point is not to contradict her. What desires have children? Give them liberty in all their movements, and they have a plenitude of existence, an abundance of that kind of happiness which is confined in some sort to all the objects which surround them: but if all beings were happy on the same conditions, society would be at no expence in procuring the happiness of the different individuals who compose it. Sensation is the foundation of reflection; it is the principal attribute of the soul; it is by this that man is elevated to sublime speculations, and secures his dominion over nature and himself. This quality is not stationary, but susceptible, like all other relative qualities, of increase and decay, of different degrees of strength and intenseness: it is different in different men; and in the same man it increases from infancy to youth, from youth to confirmed manhood: at this period it stops, and gradually declines as we proceed to old age and to second childishness. Considered physically, it varies according to age, constitution, climate, and food; considered in a moral point of view, it takes its different appearances from individual education, and from the habits of society; for man in a state of nature and society, with regard to sensation and the unfolding of his powers, may be considered as two distinct beings: and if one were to make a calculation of pleasure in the course of human life, a man of fortune and capacity enjoys more than ten thousand savages.

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† Dr Sayers.

* Disquisitions Metaphysical and Literary.

"Pleasure and pain being relative qualities, they may be almost annihilated in the moment of vehement passion. In the heat of battle, for example, ardent and animated spirits have not felt the pain of their wounds; and minds strongly penetrated with sentiments of religion, enthusiasm, and humanity, have supported the most cruel torments with courage and fortitude. The sensibility of some persons is so exquisitely alive, that one can scarcely approach them without throwing them into convulsions. Many diseases show the effect of sensibility pushed to an extreme; such as hysteric affections, certain kinds of madness, and some of those which proceed from poison, and from the bite or sting of certain animals, as the viper and the tarantula. Excessive joy or grief, fear and terror, have been known to destroy all sensation, and occasion death (A)."

Having made these preliminary observations on pleasure and pain in infancy, and as they are increased or diminished by education, and the different conditions of body and mind, our author proceeds to consider the capability of savages to feel pleasure and pain. "By savages he understands all the tribes of men who live by hunting and fishing, and on those things which the earth yields without cultivation. Those tribes who possess herds of cattle, and who derive their subsistence from such possessions, are not to be considered as savages, as they have some idea of property. Some savages are naturally compassionate and humane, others are cruel and sanguinary. Although the physical constitution of man be everywhere the same, yet the varieties of climate, the abundance or scarcity of natural productions, have a powerful influence to determine the inclinations; even the fierceness of the tiger is softened under a mild sky. Now nature forms the manners of savages just as society and civil institutions form the manners of civilized life. In the one case climate and food produce almost the whole effect; in the other they have scarcely any influence. The habits of society every moment contend with nature, and they are almost always victorious. The savage devotes himself to the dominion of his passions; the civilized man is employed in restraining, in directing, and in modifying them: so much influence have government, laws, society, and the fear of censure and punishment, over his soul.

"It is not to be doubted that savages are susceptible both of pleasure and pain; but are the impressions made on their organs as sensible, or do they feel pain in the same degree with the inhabitants of a civilized country?

"Their enjoyments are so limited, that if we confine ourselves to truth, a few lines will be sufficient to describe them: our attention must therefore be confined to pain, because the manner in which they support misfortune, and even torture, presents us with a view of character unequalled in the history of civilized nations. It is not uncommon in civilized countries to see men braving death, meeting it with cheerfulness, and even not uttering complaints under the torture; but they do not insult the executioners of public vengeance, and defy pain in order to augment their torments; and those who are condemned by the laws suffer the punishment with different degrees of fortitude. On those mournful occasions, the common ranks of mankind in general die with less firmness: those, on the other hand, who have received education, and who, by a train of unfortunate events are brought to the scaffold, whether it be the fear of being reproached with cowardice, or the consideration that the stroke is inevitable, such men discover the expiring sighs of self-love even in their last moments; and those especially of high rank, from their manners and sentiments, are expected to meet death with magnanimity: but an American savage in the moment of punishment appears to be more than human; he is a hero of the first order, who braves his tormentors, who provokes them to employ all their art, and who considers as his chief glory to bear the greatest degree of pain without shrinking (see AMERICA, N° 14, 27, 28, 29.). The recital of their tortures would appear exaggerated, if it were not attested by the best authority, and if the savage nations among whom those customs are established were not sufficiently known; but the excess of the cruelty is not so astonishing as the courage of the victim. The European exposed to sufferings of the same dreadful nature would rend heaven and earth with his piercing cries and horrible groans; the reward of martyrdom, the prospect of eternal life, could alone give him fortitude to endure such torments; but the savage is not animated with this exalted hope. What supports him then in scenes of so exquisite suffering? The feeling of shame, the fear of bringing reproach on his tribe, and giving a stain to his fellows never to be wiped away, are the only sentiments which influence the mind of a savage, and which always present to his imagination, animate him, support him, and lend him spirit and resolution. At the same time, however powerful those motives may be, they would not be alone sufficient, if the

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(A) There are instances of persons who have died at the noise of thunder without being touched. A man frightened with the fall of a gallery in which he happened to be, was immediately seized with the black jaundice. M. le Cat mentions a young person on whom the insolence of another made such an impression, that his countenance became at first yellow, and then changed into black, in such a manner that in less than eight days he appeared to wear a mask of black velvet: he continued in this state for four months, without any other symptom of bad health or any pain. A sailor was so terrified in a storm, that his face sweated blood, which like ordinary sweat returned as it was wiped off. Stahl, whose testimony cannot be called in question, cites a similar case of a girl who had been frightened with soldiers. The excess of fear, according to many physicians, produces madness and epilepsy.

the savage felt pain in the same degree with the European. Sensibility, as we have already observed, is increased by education; it is influenced by society, manners, laws, and government; climate and food work it into a hundred different shapes; and all the physical and moral causes contribute to increase and diminish it. The habitual existence of a savage would be a state of suffering to an inhabitant of Europe. You must cut the flesh of the one and tear it away with your nails, before you can make him feel in an equal degree to a scratch or prick of a needle in the other. The savage, doubtless, suffers under torture, but he suffers much less than an European in the same circumstances: the reason is obvious; the air which the savages breathe is loaded with fog and moist vapours; their rivers not being confined by high banks, are by the winds as well as in floods spread over the level fields, and deposit on them a putrid and pernicious slime; the trees squeezed one upon another, in that rude and uncultivated country, serve rather as a covering to the earth than an ornament. Instead of those fresh and delicious shades, those openings in the woods, and walks crossing each other in all directions, which delight the traveller in the fine forests of France and Germany; those in America serve only to intercept the rays of the sun, and to prevent the benign influence of his beams. The savage participates of this cold humidity; his blood has little heat, his humours are gross, and his constitution phlegmatic. To the powerful influence of climate, it is necessary to join the habits of his life. Obliged to traverse vast deserts for subsistence, his body is accustomed to fatigue; food not nourishing, and at the same time in no great plenty, blunts his feelings; and all the hardships of the savage state give a rigidity to his members which makes him almost incapable of suffering. The savage in this state of nature may be compared to our water-women and street-porters, who, though they possess neither great vigour nor strength, are capable of performing daily, and without complaint, that kind of labour which to a man in a different condition of life would be a painful and grievous burden. Feeling, in less perfection with the savage, by the effects of climate and food, and the habits of his life, is still farther restrained by moral considerations. The European is less a man of nature than of society: moral restraints are powerful with him; while over the American they have scarcely any influence. This latter then is in a double condition of imperfection with regard to us; his senses are blunted, and his moral powers are not disclosed. Now, pleasure, and pain depending on the perfection of the senses and the unfolding of the intellectual faculties, it cannot be doubted, that in enjoyments of any kind savages experience less pleasure, and in their suffering less pain, than Europeans in the same circumstances. And in fact, the savages of America possess a very feeble constitution. They are agile without being strong; and this agility depends more on their habits than on the perfection of their members: they owe it to the necessity of hunting; and they are moreover so weak, that they were unable to bear the toil which their first oppressors imposed on them. Hence a race of men in all respects so imperfect could not endure torment under which the most robust European would sink; if the pain which they feel were really as great as it appears to be. Feeling is then, and must necessarily be, less in the savage condition; for this faculty disclosing itself by the exercise of all the physical and moral qualities, must be less as they are less exercised. Every thing shows the imperfection of this precious quality, this source of all our affections, in the American savages.

"All the improvements in Europe have had a tendency to unfold sensibility: the air is purified that we may breathe more freely; the morasses are drained, the rivers are regulated in their courses, the food is nourishing, and the houses commodious. With the savages, on the contrary, every thing tends to curb it; they take pleasure even in hardening the organs of the body, in accustoming themselves to bear by degrees the most acute pain without complaining. Boys and girls among the savages amuse themselves with tying their naked arms together, and laying a kindled coal between them, to try which of them can longest suffer the heat; and the warriors who aspire to the honour of being chief, undergo a course of suffering which exceeds the idea of torture inflicted on the greatest criminals in Europe."

These observations on the pleasures and pains of savages appear to be well-founded, and, as the attentive reader will perceive, are perfectly agreeable to the theory of Dr Sayers. If indeed that theory be just, as we believe it to be, it will follow, that the few pleasures of sense which the American enjoys, he ought to enjoy more completely than any European, because to him they recur but seldom. This may very possibly be the case; and certainly would be so, were not his fibres, by climate and the habits of his life, rendered more rigid than those of the civilized part of the inhabitants of Europe. But if we agree with our author * in what he says of the pains and pleasures of savages, we cannot admit, without many exceptions, his theory of the enjoyments of children. It is so far from being true, that few things amuse, and that nothing satisfies them, that the direct contrary must have been observed by every man attentive to the operations of the infant mind, which is amused with every thing new, and often completely satisfied with the merest trifle. The pleasures of philosophy are not indeed unfolded to the infant; but it by no means follows that he does not enjoy his rattle and his drum as much as the philosopher enjoys his telescope and air-pump; and if there be any truth in the science of physiognomy, the happiness of the former is much more pure and exquisite than that of the latter. That the most perfect music is vain noise to an infant, is far from being self-evident, unless the author confines the state of infancy to a very few months; and we are not disposed to believe, without better proof than we have yet received, that the relish of exquisite perfumes and highly seasoned dishes adds much to the sum of human felicity.

But however much we disapprove of many of these reflections, the following we cordially adopt as our own. "If we compare (says our author) the pleasures of sense with those which are purely intellectual, we shall find that the latter are infinitely superior to the former, as they may be enjoyed at all times and in every situation of life. What are the pleasures of the table, says Cicero, of gaming, and of women, compared with the delight of study? This taste increases with age, and no

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* Encyclopédie Méthodique, Logique, Métaphysique et Morale, tom. ii.

happiness is equal to it. Without knowledge and study, says Cato, life is almost the image of death (B). The pleasures of the soul are such, that it is frequent enough to see men preserve their gaiety during their whole life, notwithstanding a weak, diseased, and debilitated body. Scaron, who lived in the last century, was an example of this. Balzac, speaking of him, says, that Prometheus, Hercules, and Philoctetes, in profane, and Job in sacred, history, said many great things while they were afflicted with violent pain: but Scaron alone said pleasant things. I have seen, continues he, in many places of ancient history, constancy, and modesty, and wisdom, and eloquence, accompanying affliction; but he is the only instance wherein I have seen pleasantry.

"There are men whose understandings are constantly on the stretch, and by this very means they are improved; but if the body were as constantly employed in the pursuit of sensual gratification, the constitution would soon be destroyed. The more we employ the mind we are capable of the greater exertion; but the more we employ the body we require the greater repose. There are besides but some parts of the body capable of enjoying pleasure; every part of it can experience pain. A toothach occasions more suffering than the most considerable of our pleasures can procure of enjoyment. Great pain may continue for any length of time; excessive pleasures are almost momentary. Pleasure carried to an extreme becomes painful; but pain, either by augmenting or diminishing it, never becomes agreeable. For the moment, the pleasures of the senses are perhaps more satisfactory; but in point of duration those of the heart and mind are infinitely preferable. All the sentiments of tenderness, of friendship, of gratitude, and of generosity, are sources of enjoyment for man in a state of civilization. The damned are exceedingly unhappy, said St Catherine de Sienna, if they are incapable of loving or being beloved.

"Pleasure, continued for a great length of time, produces languor and fatigue, and excites sleep; the continuation of pain is productive of none of these effects. Many suffer pain for eight days and even a month without interruption; an equal duration of excessive pleasure would occasion death.

"Time is a mere relative idea with regard to pleasure and pain; it appears long when we suffer, and short when we enjoy. If there existed no regular and uniform movement in nature, we would not be able from our sensations alone to measure time with any degree of exactness, for pain lengthens and pleasure abridges it. From the languor of unoccupied time has arisen the proverb expressive of our desire to *kill* it. It is a melancholy reflection, and at the same time true, that there is no enjoyment which can effectually secure us from pain for the remainder of our lives; while there are examples of evils which hold men in constant sorrow and pain during their whole existence. Such then is the imperfection of the one and the power of the other.

"Pleasure and pain are the sources of morality; an action is just or unjust, good or otherwise, only as its natural tendency is to produce suffering or enjoyment to mankind. No crime could be committed against a being altogether insensible, nor could any good be bestowed on it. Unless he were endowed with the desire of pleasure and the apprehension of pain, man, like an automaton, would act from necessity, without choice and without determination.

"All our passions are the developement of sensibility. If we were not possessed of feeling, we should be destitute of passions; and as sensibility is augmented by civilization, the passions are multiplied; more active and vigorous in an extensive and civilized empire than in a small state; more in the latter than among barbarous nations; and more in these last than among savages (see PASSION). There are more passions in France and England than in all the nations of Europe; because every thing which serves to excite and foster them is always in those countries in the greatest state of fermentation. The mind is active; the ideas great, extensive, and multiplied. And is it not the soul, the mind, and heart, which are the focus of all the passions?"

But wherever the passions are multiplied, the sources of pleasure and pain are multiplied with them. This being the case, it is impossible to prescribe a fixed and general rule of happiness suited to every individual. There are objects of pleasure with regard to which all men of a certain education are agreed; but there are perhaps many more, owing to the variety of tempers and education, about which they differ. Every man forms ideas of enjoyment relative to his character; and what pleases one may be utterly detested by another. In proportion as a nation is civilized and extensive, those differences are remarkable. Savages, who are not acquainted with all the variety of European pleasures, amuse themselves with very few objects. Owing to the want of civilization, they have scarcely any choice in the objects of taste. They have few passions; we have many. But even in the nations of Europe, pleasure is infinitely varied in its modification and forms. Those differences arise from manners, from governments, from political and religious customs, and chiefly from education. Meanwhile, however different and variable the ideas of pleasure may be among nations and individuals, it still remains a fact, that a certain number of persons in all civilized states, whether distinguished by birth, or rank, or fortune, or talents, as they have nearly the same education so they form nearly the same ideas of happiness: but to possess it a man must give his chief application to the state of his mind; and notwithstanding all his efforts it is of uncertain duration. Happiness is the sunshine of life: we enjoy it frequently at great intervals; and it is therefore necessary to know how to use

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(B) "Savages, barbarians, and peasants, enjoy little happiness except that of sensation. The happiness of a civilized and well-informed man consists of sensations, of ideas, and of a great number of affinities, altogther unknown to them. He not only enjoys the present, but the past and the future. He recals the agreeable idea of pleasures which he has tasted. It is great happiness, says an ancient, to have the recollection of good actions, of an upright intention, and of promises which we have kept."

use it. All the productions of art perish; the largest fortunes are dissipated; rank, honour, and dignity, pass away like a fleeting shadow; the memory is impaired; all the faculties of the soul are extinguished; the body sinks under the infirmities of old age; and scarcely has one reached the boundaries of happiness marked out by his imagination, when he must give place to another, and renounce all his pleasures, all his hopes, all his illusions; the fugitive images of which had given happiness to the mind.

There are pleasures, however, on which the mind may securely rest, which elevate man above himself, dignify his nature, fix his attention on spiritual things, and render him worthy of the care of Providence. These are to be found in true religion; which procures for those who practise its duties inexpressible happiness in a better country, and is in this world the support of the weak, and the sweet consolation of the unfortunate.

PLEBEIAN, any person of the rank of the common people. It is chiefly used in speaking of the ancient Romans, who were divided into senators, patricians, and plebeians. The distinction was made by Romulus the founder of the city; who confined all dignities, civil, military, and sacerdotal, to the rank of patricians. But to prevent the seditions which such a distinction might produce through the pride of the higher order and the envy of the lower, he endeavoured to engage them to one another by reciprocal ties and obligations. Every plebeian was allowed to choose, out of the body of the patricians, a protector, who should be obliged to assist him with his interest and substance, and to defend him from oppression. These protectors were called *patrons*; the protected, *clients*. It was the duty of the patron to draw up the contracts of the clients, to extricate them out of their difficulties and perplexities, and to guard their ignorance against the artfulness of the crafty. On the other hand, if the patron was poor, his clients were obliged to contribute to the portions of his daughters, the payment of his debts, and the ransom of him and his children if they happened to be taken in war. The client and patron could neither accuse nor bear witness against each other; and if either of them was convicted of having violated this law, the crime was equal to that of treason, and any one might with impunity slay the offender as a victim devoted to Pluto and the infernal gods. For more than 600 years we find no dissensions or jealousies between the patrons and their clients; not even in the times of the republic, when the people frequently mutinied against the great and powerful.

PLECTRANTHUS, a genus of plants belonging to the didynamia class; and in the natural method ranking under the 42d order, *Verticillatæ*. See BOTANY *Index*.

PLEDGE (*Plegius*), in common law, a surety or gage, either real or personal, which the plaintiff or demandant is to find for his prosecuting the suit.

The word is sometimes also used for *FRANK Pledge*, which see.

To PLEDGE, in drinking, denotes to warrant, or be surety to one, that he shall receive no harm while he is taking his draught. The phrase is referred by antiquaries to the practice of the Danes heretofore in England, who frequently used to stab or cut the throats of the natives while they were drinking.

PLEDGES *of Goods* for money. See PAWN.

PLEDGERY, or PLEGGERY, in *Law*, suretiship, or an undertaking or answering for another.

PLEDGET, BOLSTER, or *Compress*, in *Surgery*, a kind of flat tent laid over a wound, to imbibe the superfluous humours, and to keep it clean.

PLEIADES, in fabulous history, the seven daughters of Atlas king of Mauritania and Pleione, were thus called from their mother. They were Maia, Electra, Taygete, Asterope, Merope, Halcyone, and Celœno; and were also called *Atlantides*, from their father Atlas. These princesses were carried off by Busiris king of Egypt; but Hercules having conquered him, delivered them to their father: yet they afterwards suffered a new persecution from Orion, who pursued them five years, till Jove, being prevailed on by their prayers, took them up into the heavens, where they form the constellation which bears their name.

PLEIADES, in *Astronomy*, an assemblage of seven stars, in the neck of the constellation Taurus.

They are thus called from the Greek πλειν, *navigare*, "to sail;" as being terrible to mariners, by reason of the rains and storms that frequently rise with them. The Latins called them *vergiliæ*, from *ver*, "spring;" because of their rising about the time of the vernal equinox. The largest is of the third magnitude, and is called *lucida pleiadum*.

PLENARY, something complete or full. Thus we say the pope grants *plenary* indulgences; i. e. full and entire remissions of the penalties due to all sins. See INDULGENCES.

PLENIPOTENTIARY, a person vested with full power to do any thing. See AMBASSADOR.

PLENITUDE, the quality of a thing that is full, or that fills another. In medicine, it chiefly denotes a redundancy of blood and humours.

PLENUM, in *Physics*, denotes, according to the Cartesians, that state of things wherein every part of space is supposed to be full of matter, in opposition to a VACUUM, which is a space supposed devoid of all matter.

PLENUS FLOS, a full flower; a term expressive of the highest degree of luxuriance in flowers. See BOTANY. Such flowers, although the most delightful to the eye, are both vegetable monsters, and, according to the sexualists, vegetable eunuchs; the unnatural increase of the petals constituting the first; the consequent exclusion of the stamina or male organs, the latter. The following are well-known examples of flowers with more petals than one; ranunculus, anemone, marshmarygold, columbine, fennel-flower, poppy, peony, pink, gilliflower, campion, viscous campion, lily, crown imperial, tulip, narcissus, rocket, mallow, Syrian mallow, apple, pear, peach, cherry, almond, myrtle, rose, and strawberry.

Flowers with one petal are not so subject to fullness. The following, however, are instances: polyanthus, hyacinth, primrose, crocus, meadow-saffron, and thornapple; though Kramer has asserted that a full flower with one petal is a contradiction in terms. In flowers with one petal, the mode of luxuriance, or impletion, is by a multiplication of the divisions of the limb or upper part; in flowers with more petals than one, by a multiplication of the petals or nectarium.

To take a few examples. Columbine is rendered full in three different ways: by the multiplication of its petals, and total exclusion of the nectaria; 2. By the multiplication of the nectaria, and exclusion of the petals; or, 3. By such an increase of the nectaria only as does not exclude the petals, between each of which are interjected three nectaria, placed one within another. Again, fennel-flower is rendered full by an increase of the nectaria only; narcissus, either by a multiplication of its cup and petals, or of its cup only: larkspur commonly by an increase of the petals and exclusion of the spur, which is its nectarium. In *saponaria concava anglia* the impletion is attended with the singular effect of incorporating the petals, and reducing their number from five to one; and in gelder-rose, the luxuriance is effected by an increase both in magnitude and number of the circumference or margin of the head of flowers, in the plain, wheel-shaped, barren florets; and an exclusion of all the bell-shaped hermaphrodite florets of the centre or disk.

Hitherto we have treated of plenitude in simple flowers only: the instance just now adduced seems to connect the different modes of impletion in them and compound flowers. Before proceeding farther, however, it will not be improper to premise, that as a simple luxuriant flower is frequently, by beginners, mistaken for a compound flower in a natural state, such flowers may always be distinguished with certainty by this rule: That in simple flowers, however luxuriant, there is but one pistillum or female organ; whereas, in compound flowers, each floret, or partial flower, is furnished with its own proper pistillum. Thus in hawk-weed, a compound flower, each flat or tongue-shaped floret in the aggregate has its five stamina and naked seed, which last is in effect its pistillum; whereas, in a luxuriant lychnis, which is a simple flower, there is found only one pistillum or female organ common to the whole.

In a compound radiated flower, which generally consists of plain florets in the margin or radius, and tubular or hollow florets in the centre or disc, plenitude is effected either by an increase of the florets in the margin, and a total exclusion of those in the disc; which mode of luxuriance is termed *impletion by the radius*, and resembles what happens in the gelder-rose: or by an elongation of the hollow florets in the centre and a less profound division of their brims; which is termed *impletion of the disc*. In the first mode of luxuriance, the florets in the centre, which are always hermaphrodite or male, are entirely excluded; and in their place succeed florets similar in sex to those of the radius. Now as the florets in the margin of a radiated compound flower are found to be always either female, that is, furnished with the pistillum only; or neuter, that is, furnished with neither stamina nor pistillum; it is evident, that a radiated compound flower, filled by the radius, will either be entirely female, as in feverfew, daisy, and African marigold; or entirely neuter, as in sun-flower, marygold, and centaury: hence it will always be easy to distinguish such a luxuriant flower from a compound flower with plain florets in a natural state; as these flowers were all hermaphrodite, that is, furnished with both stamina and pistillum. Thus the full flowers of African marigold have each floret furnished with the pistillum or female organ only: the natural flowers of dandelion, which, like the former, is composed of plain florets, are furnished with both stamina and pistillum.

In the second mode of luxuriance, termed *impletion by the disc*, the florets in the margin sometimes remain unchanged: but most commonly adopt the figure of those in the centre, without, however suffering any alteration in point of sex; so that confusion is less to be apprehended from this mode of luxuriance than from the former; besides the length to which the florets in the centre run out is of itself a sufficient distinction, and adapted to excite at once an idea of luxuriance. Daisy, feverfew, and African marigold, exhibit instances of this as well as of the former mode of impletion.

In luxuriant compound flowers with plain florets, the *semiflosculosi* of Tournefort, the stigma or summit of the style in each floret is lengthened, and the seed-buds are enlarged and diverge; by which characters such flowers may always be distinguished from flowers of the same kind in a natural state. Scorzonera, nipple-wort, and goat's-beard, furnish frequent instances of the plenitude alluded to.

Lastly, the impletion of compound flowers with tubular or hollow florets, the *flosculosi* of Tournefort, seems to observe the same rules as that of radiated flowers just delivered. In everlasting-flower, the *xeranthemum* of Linnæus, the impletion is singular, being effected by the enlargement and expansion of the inward chaffy scales of the calyx. These scales, which become coloured, are greatly augmented in length, so as to overtop the florets, which are scarce larger than those of the same flower in a natural state. The florets too in the margin, which in the natural flower are female, become, by luxuriance, barren; that is, are deprived of the pistillum; the style, which was very short, spreads, and is of the length of the chaffy scales; and its summits, formerly two in number, are metamorphosed into one.

Full flowers are more easily referred to their respective genera in methods founded upon the calyx, as the flower-cup generally remains unaffected by this highest degree of luxuriance.

PLEONASM, a figure in *Rhetoric*, whereby we use words seemingly superfluous, in order to express a thought with the greater energy; such as, "I saw it with my own eyes." &c. See ORATORY, Nº 67.

PLESCOW, a town of Russia, capital of a duchy of the same name, with an archbishop's see, and a strong castle. It is a large place, and divided into four parts, each of which is surrounded with walls. It is seated on the river Muldow, where it falls into the lake Plescow, 80 miles south of Narva, and 150 south by west of Petersburg. E. Long. 27. 52. N. Lat. 57. 58.

PLESCOW, a duchy in Russia, between the duchies of Novogorod, Lithuania, Livonia, and Ingria.

PLESSIS-LES-TOURS, formerly a royal palace of France, within half a league of Tours. It was built by Louis XI. and in it he died in the year 1483. It is situated in a plain surrounded by woods, at a small distance from the Loire. The building is yet handsome, though built of brick, and converted to purposes of commerce.

PLETHORA, in *Medicine*, from πληθος, "plenitude." A plethora is when the vessels are too much loaded with fluids. The plethora may be sanguine or serous. In the first there is too much crassamentum in the blood, in the latter too little. In the sanguine plethora, there is danger of a fever, inflammation, apoplexy, rupture of the blood-vessels, obstructed secretions, &c. in the serous, of a dropsy, &c. A rarefaction of the blood produces all the effects of a plethora; it may accompany a plethora, and should be distinguished therefrom. Mr Bromfield observes, that a sanguine plethora may thus be known to be present by the pulse. An artery overcharged with blood is as incapable of producing a strong full pulse, as one that contains a deficient quantity; in both cases there will be a low and weak pulse. To distinguish rightly, the pulse must not be felt with one or two fingers on the carpal artery; but if three or four fingers cover a considerable length of the artery, and we press hard for some time on it, and then suddenly raise all these fingers except that which is nearest to the patient's hand, the influx of the blood, if there is a plethora, will be so rapid as to raise the other finger, and make us sensible of the fulness. The sanguine plethora is relieved by bleeding: the serous by purging, diuretics, and sweating. See MEDICINE *Index*.

PLEURA, in *Anatomy*, a thin membrane covering the inside of the thorax. See ANATOMY *Index*.

PLEURITIS, or PLEURISY. See MEDICINE *Index*.

PLEURONECTES, a genus of fishes belonging to the order of thoracici. See ICHTHYOLOGY *Index*.

PLEURS, a town in France, which was buried under a mountain in the year 1618. Of this fatal circumstance, Bishop Burnet, in his travels, p. 96. gives the following account. "Having mentioned (says the Bishop) some falls of mountains in these parts (viz. near the Alps), I cannot pass by the extraordinary fate of the town of Pleurs, about a league from Chavennes to the north.—The town was half the bigness of Chavennes, but much more nobly built; for, besides the great palace of the Francken, that cost some millions, there were many other palaces built by rich factors both of Milan and the other parts of Italy, who, liking the situation and air, as well as the freedom of the government, gave themselves all the indulgencies that a vast wealth could furnish. By one of the palaces that was a little distant from the town, and was not overwhelmed with it, one may judge of the rest. It was an out-house of the family of the Francken, and yet it may compare with many palaces in Italy. The voluptuousness of this place became very crying; and Madame de Salis told me that she heard her mother often relate some passages of a Protestant minister's sermons that preached in a little church there, who warned them often of the terrible judgments of God which were hanging over their heads, and which he believed would suddenly break out upon them.

"On the 25th of August 1618, an inhabitant came and told me to be gone, for he saw the mountains cleaving; but he was laughed at for his pains. He had a daughter whom he persuaded to leave all and go with him; but when she was safe out of town, she called to mind that she had not locked the door of a room in which she had some things of value, and so she went back to do that, and was buried with the rest; for at the hour of supper the hill fell down, and buried the town and all the inhabitants, to the number of 2200, so that not one person escaped. The fall of the mountains did so fill the channel of the river, that the first news those of Chavennes had of it was by the failing of their river; for three or four hours there came not a drop of water, but the river wrought for itself a new course, and returned to them.

"I could hear no particular character of the man who escaped (continues the Bishop); so I must leave the secret reason of so singular a preservation to the great discovery, at the last day, of those steps of Divine Providence that are now so unaccountable. Some of the family of the Francken, got some miners to work under ground, to find out the wealth that was buried in their house; for, besides their plate and furniture, there was a great deal of cash and many jewels in the house. The miners pretended they could find nothing; but they went to their country of Tyrol and built fine houses, and a great wealth appeared, of which no other visible account could be given but this, that they had found some of that treasure."

PLEXUS, among anatomists, a bundle of small vessels interwoven in the form of net-work; thus a congeries of vessels within the brain is called *plexus choroides*, *reticularis*, or *retiformis*. See ANATOMY.

A plexus of nerves is the union of two or more nerves, forming a sort of ganglion or knot.

PLICA POLONICA, or *Plaited Hair*, is a disease peculiar to Poland; whence the name. See MEDICINE, N° 355. Mr Coxe, who gives a short account of it, attempts likewise to give the physical causes of it. Many causes of this kind, he tells us, have been supposed to concur in rendering the plica more frequent in those regions than in other parts. It would be an endless work to enumerate the various conjectures with which each person has supported his favourite hypothesis.—The most probable are those assigned by Dr Vicat: The first cause is the nature of the Polish air, which is rendered insalubrious by numerous woods and morasses, and occasionally derives an uncommon keenness even in the midst of summer from the position of the Carpathian mountains; for the southern and south-easterly winds, which usually convey warmth in other regions, are in this chilled in their passage over their snowy summits. The second is, unwholesome water; for although Poland is not deficient in good springs, yet the common people usually drink that which is nearest at hand, taken indiscriminately from rivers, lakes, and even stagnant pools. The third cause is the gross inattention of the natives to cleanliness; for experience shows, that those who are not negligent in their persons and habitations, are less liable to be afflicted with the plica than others who are deficient in that particular. Thus persons of higher rank are less subject to this disorder than those of inferior stations; the inhabitants of large towns than those of small villages; the free peasants than those in an absolute state of vassalage; the natives of Poland Proper than those of Lithuania. Whatever we may determine as to the possibility that all or any of these causes, by themselves, or in conjunction with others, originally produced the disorder; we may venture to assert, that they all, and particularly the last, assist its propagation, inflame its symptoms, and protract its cure.

In a word, the plica polonica appears to be a contagious distemper; which, like the leprosy, still prevails among a people ignorant in medicine, and inattentive to check its progress, but is rarely known in those countries where proper precautions are taken to prevent its spreading.

PLIMPTON, a town of Devonshire, in England, seated on a branch of the river Plime, which had once a castle, now in ruins. It sends two members to parliament;

ment; is seven miles E. of Plymouth, and 218 W. by S. of London. W. Long. 40. 0. N. Lat. 50. 22.

PLINIA, a genus of plants belonging to the polyandria class of Linnæus. See BOTANY *Index*.

PLINTH, ORLE, or *Orlo*, in *Architecture*, a flat square member, in the form of a brick. It is used as the foundation of columns, being that flat square table under the moulding of the base and pedestal at the bottom of the whole order. It seems to have been originally intended to keep the bottom of the original wooden pillars from rotting. Vitruvius also calls the Tuscan abacus *plinth*.

PLINTH of a Statue, &c. is a base, either flat, round, or square, that serves to support it.

PLINTH of a Wall, denotes two or three rows of bricks advancing out from a wall; or, in general, any flat high moulding, that serves in a front-wall to mark the floors, to sustain the eaves of a wall, or the larmier of a chimney.

PLINY the ELDER, or *Cæcilius Plinius Secundus*, one of the most learned men of ancient Rome, was descended from an illustrious family, and born at Verona. He bore arms in a distinguished post; was one of the college of augurs; became intendant of Spain; and was employed in several important affairs by Vespasian and Titus, who honoured him with their esteem. The eruption of Mount Vesuvius, which happened in the year 79, proved fatal to him. His nephew, Pliny the Younger, relates the circumstances of that dreadful eruption, and the death of his uncle, in a letter to Tacitus. Pliny the Elder wrote a Natural History in 37 books, which is still extant, and has had many editions; the most esteemed of which is that of Father Hardouin, printed at Paris in 1723, in two volumes folio.

PLINY the Younger, the nephew of the former, was born in the ninth year of Nero, and the 62d of Christ, at Novocomum, a town upon the lake Larius, near which he had several beautiful villas. Cæcilius was the name of his father, and Plinius Secundus that of his mother's brother, who adopted him. He brought into the world with him fine parts and an elegant taste, which he did not fail to cultivate early; for, as he tells us himself, he wrote a Greek tragedy at 14 years of age. He lost his father when he was young; and had the famous Virginius for his tutor or guardian, whom he has set in a glorious light. He frequented the schools of the rhetoricians, and heard Quintilian; for whom he ever after entertained so high an esteem, that he bestowed a considerable portion upon his daughter at her marriage. He was in his 18th year when his uncle died; and it was then that he began to plead in the forum, which was the usual road to dignities. About a year after, he assumed the military character, and went into Syria with the commission of tribune: but this did not suit his taste any more than it had done Tully's; and therefore we find him returning after a campaign or two. He tells us, that in his passage homewards he was detained by contrary winds at the island Icaria, and how he employed himself in making verses: he enlarges in the same place upon his poetical exercitations; yet poetry was not the shining part of his character any more than it had been of Tully's.

Upon his return from Syria, he married a wife, and settled at Rome: it was in the reign of Domitian. During this most perilous time, he continued to plead in the forum, where he was not more distinguished by his uncommon abilities and eloquence, than by his great resolution and courage, which enabled him to speak boldly, when scarcely one else durst speak at all. On these accounts he was often singled out by the senate to defend the plundered provinces against their oppressive governors, and to manage other causes of a like important and dangerous nature. One of these was for the province of Bætica, in their prosecution of Bæbius Massa; in which he acquired so general an applause, that the emperor Nerva, then a private man, and in banishment at Tarentum, wrote to him a letter, in which he congratulated not only Pliny, but the age which had produced an example so much in the spirit of the ancients. Pliny relates this affair in a letter to Cornelius Tacitus; and he was so pleased with it himself, that he could not help intreating this friend to record it in his history. He intreats him, however, with infinitely more modesty than Tully had intreated Lucceius upon the same occasion: and though he might imitate Cicero in the request, as he professes to have constantly set that great man before him for a model, yet he took care not to transgress the bounds of decency in his manner of making it. He obtained the offices of questor and tribune, and luckily went unhurt through the reign of Domitian: there is, however reason to suppose, if that emperor had not died just as he did, that Pliny would have shared the fate of many other great men; for he tells us himself, that his name was afterwards found in Domitian's tables, among the number of those who were destined to destruction.

He lost his wife in the beginning of Nerva's reign, and soon after married his beloved Calphurnia, of whom we read so much in his Epistles. He had not, however, any children by any of his wives: and hence we find him thanking Trajan for the *jus trium liberorum*, which he afterwards obtained of that emperor for his friend Suetonius Tranquillus. He hints also, in his letter of thanks to Trajan, that he had been twice married in the reign of Domitian. He was promoted to the consulate by Trajan in the year 100, when he was 38 years of age; and in this office pronounced that famous panegyric, which has ever since been admired, as well for the copiousness of the topics as the elegance of address. Then he was elected augur, and afterwards made proconsul of Bithynia; whence he wrote to Trajan that curious letter concerning the primitive Christians; which, with Trajan's rescript, is happily extant among his Epistles. Pliny's letter, as Mr Melmoth observes in a note upon the passage, is esteemed as almost the only genuine monument of ecclesiastical antiquity relating to the times immediately succeeding the apostles, it being written at most not above 40 years after the death of St Paul. It was preserved by the Christians themselves, as a clear and unsuspicious evidence of the purity of their doctrines, and is frequently appealed to by the early writers of the church against the calumnies of their adversaries. It is not known what became of Pliny after his return from Bithynia; whether he lived at Rome, or what time he spent at his country houses. Antiquity is also silent as to the time of his death: but it is conjectured that he died either a little before or soon after that excellent prince, his admired Trajan; that is, about the year of Christ 116.

Pliny was one of the greatest wits, and one of the worthiest men, among the ancients. He had fine parts, which he cultivated to the utmost; and he accomplished himself with all the various kinds of knowledge which could serve to make him either useful or agreeable. He wrote and published a great number of things; but nothing has escaped the wreck of time except the books of Letters, and the panegyric upon Trajan. This has ever been considered as a masterpiece: and if he has, as some think, almost exhausted all the ideas of perfection in a prince, and gone perhaps a little beyond the truth, yet it is allowed that no panegyrist was ever possessed of a finer subject, and on which he might better indulge in all the flow of eloquence, without incurring the suspicion of flattery and lies. His letters seem to have been intended for the public; and in them he may be considered as writing his own memoirs. Every epistle is a kind of historical sketch, wherein we have a view of him in some striking attitude either of active or contemplative life. In them are preserved anecdotes of many eminent persons, whose works have come down to us, as Suetonius, Silius Italicus, Martial, Tacitus, and Quintilian; and of curious things, which throw great light upon the history of those times. They are written with great politeness and spirit; and if they abound too much in turn and metaphor, we must impute it to that degeneracy of taste which was then accompanying the degenerate manners of Rome. Pliny, however, seems to have preserved himself in this latter respect from the general contagion: whatever the manners of the Romans were, his were pure and incorrupt. His writings breathe a spirit of transcendent goodness and humanity: his only imperfection is, he was too desirous that the public and posterity should know how humane and good he was. We have two elegant English translations of his Epistles; the one by Mr Melmoth, and the other by Lord Orrery.

PLOCAMA, a genus of plants belonging to the pentandria class. See Botany *Index*.

PLOCE. See Oratory, p. 433.

PLOCKSKO, a town of Poland, and capital of a palatinate of the same name, with a castle and a bishop's see. The churches are very magnificent; and it is built upon a hill, whence there is a fine prospect every way, near the river Vistula. It is 25 miles south-east of Uladislaw, and 65 west of Warsaw. E. Long. 19. 29. N. Lat. 52. 46.

Plocksko, formerly a palatinate of Poland, bounded on the north by Regal Prussia, on the east by the palatinate of Mazovia, on the south by the Vistula, and on the west by the palatinate of Inovladislaw. The capital town is of the same name.

PLOEN is a town of Germany in the circle of Lower Saxony, and capital of Holstein. It stands on the banks of a lake of the same name, and gave title to a duke, till by the death of the last duke Charles without male issue it escheated to the king of Denmark in 1761. The ducal palace, rising in the midst of the town, on an elevated spot of ground, and overlooking the lake, is a very picturesque object. The town stands 22 miles north-west of Lubeck, and 10 south-east of Kiell. E. Long. 10. 30. N. Lat. 54. 11.

PLOMO, in *Metallurgy*, is a name given by the Spaniards, who have the care of the silver mines, to the silver ore, when found adhering to the surface of stones, and when it incrusts their cracks and cavities like small and loose grains of gunpowder. Though these grains be few in number, and the rest of the stone have no silver in it, yet they are always very happy when they find it, as it is a certain token that there is a rich vein somewhere in the neighbourhood. And if in digging forwards they still meet with these grains, or the plomo in greater quantity, it is a certain sign that they are getting nearer and nearer the good vein.

PLOT, Dr Robert, a learned antiquarian and philosopher, was born at Sutton-barn, in the parish of Borden in Kent, in the year 1641, and studied in Magdalen-hall, and afterwards in University-college, Oxford. In 1682 he was elected secretary of the Royal Society, and published the Philosophical Transactions from N° 143 to N° 166 inclusive. The next year Elias Ashmole, Esq. appointed him first keeper of his museum, and about the same time the vice-chancellor nominated him first professor of chemistry in the university of Oxford. In 1687 he was made secretary to the Earl Marshal, and the following year received the title of *Historiographer* to King James II. In 1690 he resigned his professorship of chemistry, and likewise his place of keeper of the museum, to which he presented a very large collection of natural curiosities; which were those he had described in his histories of Oxfordshire and Staffordshire: the former published at Oxford in 1677, folio, and reprinted with additions and corrections in 1705; and the latter was printed in the same size in 1686. In January 1694-5, Henry Howard, Earl Marshal, nominated him Mobray-herald extraordinary; two days after which he was constituted register of the court of honour; and, on the 30th of April 1696, he died of the stone at his house at Borden.

As Dr Plot delighted in natural history, the above works were designed as essays towards a Natural History of England; and he had actually formed a design of travelling through England and Wales for that purpose. He accordingly drew up a plan of his scheme in a letter to the learned Bishop Fell; which is inserted at the end of the second volume of Leland's Itinerary, of the edition of 1744. Amongst several MSS. which he left behind him were large materials for the "Natural History of Kent, Middlesex, and the city of London." Besides the above works, he published *De origine fontium tentamen philosophicum*, 8vo, and nine papers in the Philosophical Transactions.

Plot, in dramatic poetry, is sometimes used for the fable of a tragedy or comedy; but more properly for the knot or intrigue, which makes the *embarras* of any piece. See Poetry.

Plot, in *Surveying*, the plan or draught of any field, farm, or manor, surveyed with an instrument, and laid down in the proper figure and dimensions.

PLOTINUS, a Platonic philosopher in the third century. He was born at Lycopolis a city of Egypt, in 204; and began very early to show a great singularity both in his taste and manners: for, at eight years of age, when he went to school, he used to run to his nurse, and uncover her breast to suck; and would have continued that practice longer, if he had not been discouraged by her. At 28 years of age he had a strong desire to study philosophy, on which occasion he was recommended to the most famous professors of Alexandria. He was not satisfied with their lectures; but upon hearing those of Ammonius, he confessed that this was the man he wanted. He studied for 11 years under that excellent master, and then went to hear the Persian and Indian philosophers: for in 243, when the emperor Gordianus intended to wage war against the Persians, he followed the Roman army, but probably repented of it; for it was with difficulty he could save his life by flight, after the emperor had been slain. He was then 39; and the year following he went to Rome, and read philosophical lectures in that city; but avoided following the example of Erennius and Origen, his fellow-pupils, who, having promised with him not to reveal some hidden and excellent doctrines they had received from Ammonius, had nevertheless forfeited their word. Plotinus continued ten years in Rome, without writing any thing; but, in his 50th year Porphyry became his scholar; who, being of an exquisitely fine genius, was not satisfied with superficial answers, but required to have all difficulties thoroughly explained; and therefore Plotinus, to treat things with greater accuracy, was obliged to write more books. He had before written 21 books, and during the six years of Pophyry's stay with him he wrote 24, and 9 after Porphyry's leaving Rome, in all 54. The Romans had a high veneration for him; and he passed for a man of such judgement and virtue, that many persons of both sexes, when they found themselves dying, intrusted him as a kind of guardian angel, with the care of their estates and children. He was the arbiter of numberless law-suits; and constantly behaved with such humanity and rectitude of mind, that he did not create himself one enemy during the 26 years he resided in Rome. He, however, did not meet with the same justice from all of his own profession; for Olympias a philosopher of Alexandria, being envious of his glory, used his utmost endeavours, though in vain, to ruin him. The emperor Gallienus, and the empress Salonina, had a very high regard for him; and, had it not been for the opposition of some jealous courtiers, they would have had the city of Campania rebuilt, and given to him with the territory belonging to it, to establish a colony of philosophers, and to have it governed by the ideal laws of Plato's commonwealth. He laboured under various disorders during the last year of his life, which obliged him to leave Rome, when he was carried to Campania to the heirs of one of his friends, who furnished him with every thing necessary; and he died there in the year 270, at the age of 66, and in the noblest manner that an heathen philosopher could do, these being his words as he breathed his last: "I am labouring with all my might to return the divine part of me to the Divine Whole which fills the universe."

We have already remarked that the ideas of Plotinus were singular and extraordinary; and we shall now show that they were so. He was ashamed of being lodged in a body, for which reason he did not care to tell the place of his birth or family. The contempt he had for all earthly things, was the reason why he would not permit his picture to be drawn: and when his disciple Amelius was urgent with him upon this head, "Is it not enough (said he) to drag after us, whithersoever we go, that image in which nature has shut us up? Do you think that we should likewise transmit to future ages an image of that image, as a sight worthy of their attention?" From the same principle, he refused to attend to his health; for he never made use of preservatives or baths, and did not even eat the flesh of tame animals. He ate but little, and abstained very often from bread; which, joined to his intense meditation, kept him very much from sleeping. In short, he thought the body altogether below his notice; and had so little respect for it, that he considered it as a prison, from which it would be his supreme happiness to be freed. When Amelius, after his death, inquired about the state of his soul of the oracle of Apollo, he was told, "that it was gone to the assembly of the blessed, where charity, joy, and a love of the union with God prevail:" and the reason given for it, as related by Porphyry, is, "that Plotinus had been peaceable, gracious, and vigilant; that he had perpetually elevated his spotless soul to God; that he had loved God with his whole heart; that he had disengaged himself to the utmost of his abilities, from this wretched life; that, elevating himself with all the powers of his soul, and by the several gradations taught by Plato, towards that Supreme Being which fills the universe, he had been enlightened by him; had enjoyed the vision of him without the help or interposition of ideas; had, in short, been often united to him." This is the account of Porphyry, who tells us also, that he himself had once been favoured with the vision. To this account, however, we need scarcely add, that little credit is due: it agrees pretty much with modern enthusiasm and the reveries of Behmenists. Plotinus had also his familiar spirit, as well as Socrates; but, according to Porphyry, it was not one of those called *demons*, but of the order of those who are called *gods;* so that he was under the protection of a genius superior to that of other men. The superiority of his genius puffed him up not a little: for when Amelius desired him to share in the sacrifices, which he used to offer up on solemn festivals, "It is their business (replied Plotinus) to come to me, not mine to go to them:" "which lofty answer (says Porphyry) no one could guess the reason of, or dared to ask."

Porphyry put the 54 books of Plotinus in order, and divided them into six enneases. The greater part of them turn on the most high-flown ideas in metaphysics; and this philosopher seems, in certain points, not to differ much from Spinoza. He wrote two books to prove, that "all being is one and the same;" which is the very doctrine of Spinoza. He inquires, in another book, "Whether there are many souls, or only one?" His manner of composing partook of the singularity of his nature: he never read over his compositions after he had written them; he wrote a bad hand, and was not exact in his orthography: he stood in need, therefore, of a faithful friend to revise and correct his writings; and he chose Porphyry for this purpose before Amelius, who had, however, been his disciple 24 years, and was very much esteemed by him. Some have accused Plotinus of plagiarism, with regard to Numenius; a slander which Amelius refuted. Longinus was once much prejudiced against our great philosopher, and wrote against his Treatise of Ideas, and against Porphyry's answer in defence of that treatise. He afterwards conceived a high esteem for him; sought industriously for all his books; and, in order to have them very correct, desired Porphyry to lend him his copy; but at the same time wrote to him in the following manner: "I always observed to you, when we were together,

gether, when we were at a distance from one another, as well as when you lived at Tyre, that I did not comprehend many of the subjects treated of by Plotinus; but that I was extremely fond of his manner of writing, the variety of his knowledge, and the order and disposition of his questions, which are altogether philosophical." "This single passage (says Bayle) shows the exalted genius, the exquisite discernment, and judicious penetration of Longinus. It cannot be denied, that most subjects which this philosopher examines are incomprehensible; nevertheless, we discover in his works a very elevated, fruitful, and capacious genius, and a close way of reasoning. Had Longinus been an injudicious critic, had he not possessed an exalted and beautiful genius, he would not have been so sensible of Plotinus's obscurity: for no persons complain less of the obscurity of a book, than those whose thoughts are confused and understanding is shallow." Marsilius Ficinus, at the request of Cosmo de Medicis, made a Latin version of the works of Plotinus, with a summary and analysis of each book; which was printed at Basil, first by itself, in 1559, and afterwards with the Greek in 1580, folio. His life was written by Porphyry, the most illustrious of his disciples.

PLOTUS, or DARTER, a genus of birds belonging to the order anseres. See ORNITHOLOGY *Index*.

PLOUGH, in *Agriculture*, a machine for turning up the soil by the action of cattle, contrived to save the time, labour, and expence, which, without this instrument, must have been employed in digging the ground, and fitting it for receiving all sorts of seed. See AGRICULTURE.

PLOUGHMAN, the person who guides the plough in the operation of tilling.

PLOUGHING, in *Agriculture*, the turning up the earth with a plough. See AGRICULTURE, *passim*.

PLOVER, the English name of several species of CHARADRIUS, ORNITHOLOGY *Index*.

PLOWDEN, EDMUND, serjeant at law, descended from an ancient family in Shropshire, was born in 1517, and was first a student of the university of Cambridge, where he spent three years in the study of philosophy and medicine. He then removed to Oxford, where, having continued his former studies about four years more, in 1552 he was admitted to the practice of physic and surgery: but probably finding the practice of the art of healing less agreeable than the study, he entered himself of the Middle Temple, and began to read law. Wood says, that in 1557 he was summer reader to that society, and Lent-reader three years after, being then serjeant and oracle of the law. He died in the year 1584, aged 67; and was buried in the Temple church. He wrote, 1. Commentaries or Reports of divers Cases, &c. in the reigns of King Edward VI. Queen Mary, and Queen Elizabeth; London, 1571, 78, 99, 1613, &c. Written in the old Norman language. 2. Queries, or a Moot-book of cases, &c. translated, methodized, and enlarged, by H. B. of Lincoln's-Inn. London, 1662, 8vo.

PLUCHE, ANTONY, a celebrated French writer, was born at Rheims in 1688, and having distinguished himself by his engaging manners and proficiency in the belles lettres, was appointed professor of humanity in the university of that city. Two years after he obtained the chair of rhetoric, and was admitted into holy orders. The bishop of Laon (Clermont) informed of his talents, conferred upon him the direction of the college of his episcopal city. By his industry and superior knowledge, a proper order and subordination soon took place in it; but some peculiar opinions respecting the affairs of the time disturbed his tranquillity, and obliged him to quit his office. The intendant of Rouen, at the request of the celebrated Rollin, entrusted him with the education of his son. Abbé Pluche having filled that place with success and great honour to himself, left Rouen and went to Paris, where, by the patronage of some literary friends and his own excellent writings, he acquired a very distinguished reputation for learning. He published, 1. *Le Spectacle de la Nature* (Nature Displayed), in 9 vols in 12mo. This work, which is equally instructive and entertaining, is written with perspicuity and elegance; but the form of dialogue which is adopted has rendered it rather prolix. The speakers, who are the Prior, the Count, and Countess, are not distinguished by any striking feature; but they have all the common character, which is tolerably pleasing, not excepting even that of the little chevalier de Breuil, who is, however, a mere scholar. This is the opinion which Abbé Desfontaines has formed of this work. Though the author has given the conversations a pretty ingenious turn, and even some vivacity, yet now and then they assume the tone of the college. 2. *Histoire du Ciel*, or History of the Heavens, in 2 vols in 12mo. In this performance we find two parts almost independent of one another. The first contains some learned inquiries into the origin of the poetic heavens. It is nearly a complete mythology, founded upon ideas which are new and ingenious. The second is the history of the opinions given by philosophers respecting the formation of the world. The author shows the inutility, the inconsistency, and uncertainty, of the most esteemed systems; and concludes with pointing out the excellence and sublime simplicity of the Mosaic account. Besides a noble and well-turned expression, we find in it an erudition which does not fatigue the mind. As to the foundation of the system explained in the first part, though it appears extremely plausible, we will not take upon us to say how far it is true: Voltaire called it *Fable du Ciel*, or a Fable of the Heavens. 3. *De Linguarum artificio*; a work which he translated with this title, *La Mecanique des Langues*, in 12mo. In this treatise he proposes a short and easy method of learning languages, which is by the use of translations instead of themes or exercises; his reflections on that subject are judicious and well expressed. 4. Harmony of the Psalms and the Gospel, or a Translation of the Psalms and Hymns of the Church, with Notes relative to the Vulgate, the Septuagint, and Hebrew Text, printed at Paris in 1764, in 12mo. In 1749, Abbé Pluche retired to Varenne St Maure, where he gave himself up entirely to devotion and study. Having become so deaf that he could not hear without the help of a trumpet, the capital afforded him little entertainment. It was in this retreat that he died of an apoplexy on the 20th of November 1761, at the age of 73 years. He possessed those qualities which form the scholar, the honest man, and the Christian: temperate in his meals, true to his word, an affectionate parent, a sensible friend, and a humane philosopher; he gave lessons of virtue in his life as well as his writings. His submission to all the dogmas of religion was very great.

Some Deists having been surprised that, in matters of faith, he should think and speak like the vulgar, his answer was, "I glory in doing so: It is infinitely more rational to believe the word of God, than to follow the glimmering lights of a reason which is limited and subject to error."

PLUG, certain pieces of timber, formed like the frustum of a cone, and used to stop the hause holes and the breaches made in the body of a ship by cannon-balls; the former of which are called *hause-plugs*, and the latter *shot-plugs*, which are formed of various sizes in proportion to the holes made by the different sizes of shot, which may penetrate the ship's sides or bottom in battle; accordingly they are always ready for this purpose.

PLUKENET, Leonard, a physician who flourished in the reign of King Charles II. was one of the most excellent and laborious botanists of that or any other age. He was author of the *Phytographia Plukenetiana*, the *Almagesticum Britannicum*, and other works of the like kind, on which he spent the greatest part of his life and fortune. His Phytography is mentioned with the highest encomiums in the Philosophical Transactions for February 1696-7. His *Opera Botanica*, with cuts, were printed at London, in 6 vols folio, in 1720.

PLUM-tree. See Prunus, Botany *Index*.

PLUMAGE, the feathers which serve birds for a covering. See Ornithology.

PLUMB-line, among artificers, denotes a perpendicular to the horizon; so called, as being commonly erected by means of a plummet.

PLUMBAGO, Lead-wort; a genus of plants belonging to the pentandria class. See Botany *Index*.

Plumbago, or *Black-Lead*. See Graphite, Mineralogy *Index*.

PLUMBERY, the art of casting and working lead, and using it in building.

As this metal melts soon and with little heat, it is easy to cast it into figures of any kind, by running it into moulds of brass, clay, plaster, &c. But the chief article in plumbery is sheets and pipes of lead; and as these make the basis of the plumber's work, we shall here give the process of making them.

In casting *sheet-lead*, a table or mould is made use of, which consists of large pieces of wood well jointed, and bound with bars of iron at the ends; on the sides of which runs a frame consisting of a ledge or border of wood, three inches thick and four inches high from the mould, called the *sharps:* The ordinary width of the mould, within these sharps, is from four to five feet; and its length is 16, 17, or 18 feet. This should be something longer than the sheets are intended to be, in order that the end where the metal runs off from the mould may be cut off, because it is commonly thin or uneven, or ragged at the end. It must stand very even or level in breadth, and something falling from the end in which the metal is poured in, viz. about an inch or an inch and a half in the length of 16 or 17 feet or more, according to the thickness of the sheets wanted; for the thinner the sheet, the more declivity the mould should have. At the upper end of the mould stands the pan, which is a concave triangular prism, composed of two planks nailed together at right angles, and two triangular pieces fitted in between them at the ends. The length of this pan is the whole breadth of the mould in which the sheets are cast; it stands with its bottom, which is a sharp edge, on a form at the end of the mould, leaning with one side against it; and on the opposite side is a handle to lift it up by, to pour out the melted lead; and on that side of the pan next the mould are two iron hooks to take hold of the mould, and prevent the pan from slipping while the melted lead is pouring out of it into the mould. This pan is lined on the inside with moistened sand, to prevent it from being fired by the hot metal. The mould is also spread over, about two inches thick, with sand sifted and moistened, which is rendered perfectly level by moving over it a piece of wood called a *strike*, and smoothing it over with a smoothing plane, which is a plate of polished brass about one-fourth of an inch thick and nine inches square, turned up on all the four edges, and with a handle fitted on to the upper or concave side. The sand being thus smoothed, it is fit for casting sheets of lead: but if they would cast a cistern, they measure out the bigness of the four sides; and having taken the dimensions of the front or fore-part, make mouldings by pressing long slips of wood, which contain the same mouldings, into the level sand; and form the figures of birds, beasts, &c. by pressing in the same manner leaden figures upon it, and then taking them off, and at the same time smoothing the surface where any of the sand is raised up by making these impressions upon it. The rest of the operation is the same in casting either cisterns or plain sheets of lead. But before we proceed to mention the manner in which that is performed, it will be necessary to give a more particular description of the *strike*. The strike, then, is a piece of board about five inches broad, and something longer than the breadth of the mould on the inside; and at each end is cut a notch about two inches deep, so that when it is used it rides upon the sharps with those notches. Before they began to cast, the strike is made ready by tacking on two pieces of an old hat on the notches, or by slipping a case of leather over each end, in order to raise the under side about one-eighth of an inch or something more above the sand, according as they would have the sheet to be in thickness; then they tallow the under edge of the strike, and lay it across the mould. The lead being melted, it is put into the pan with ladles, in which, when there is a sufficient quantity for the present purpose, the scum of the metal is swept off with a piece of board to the edge of the pan, letting it settle on the sand, which is by this means prevented from falling into the mould at the pouring out of the metal. When the lead is cool enough, which must be regulated according to the thickness of the sheets wanted, and is known by its beginning to stand with a shell or wall on the sand round the pan, two men take the pan, by the handle, or else one of them lifts it by the bar and chain fixed to a beam in the ceiling, and pour it into the mould, while another man stands ready with the strike, and as soon as they have done pouring in the metal, puts on the mould, sweeps the lead forward, and draws the overplus into a trough prepared to receive it. The sheets being thus cast, nothing remains but to roll them up or cut them into any measure wanted: but if it be a cistern, it is bent into four sides, so that the two ends may join the back, where they are soldered together; after which the bottom is soldered up.

The method of casting pipes without soldering.—To make these pipes they have a kind of little mill, with arms or levers to turn it withal. The moulds are of brass, and consist of two pieces, which open and shut by means of hooks and hinges, their inward caliber or diameter being according to the size of the pipe, usually two feet and a half. In the middle is placed a core or round piece of brass or iron, somewhat longer than the mould, and of the thickness of the inward diameter of the pipe. This core is passed through two copper rundles, one at each end of the mould, which they serve to close; and to these is joined a little copper tube about two inches long, and of the thickness the leaden pipe is intended to be of. By means of these tubes, the core is retained in the middle of the cavity of the mould. The core being in the mould, with the rundles at its two ends, and the lead melted in the furnace, they take it up in a ladle, and pour it into the mould by a little aperture at one end, made in the form of a funnel. When the mould is full, they pass a hook into the end of the core, and, turning the mill, draw it out; and then opening the mould, take out the pipe. If they desire to have the pipe lengthened, they put one end of it in the lower end of the mould, and pass the end of the core into it; then shut the mould again, and apply its rundle and tube as before, the pipe just cast serving for a rundle, &c. at the other end. Things being thus replaced, they pour in fresh metal, and repeat the operation till they have got a pipe of the length required.

For making pipes of sheet-lead, the plumbers have wooden cylinders, of the length and thickness required; and on these they form their pipes by wrapping the sheet around them, and soldering up the edges all along them.

The lead which lines the Chinese tea-boxes is reduced to a thinness which we are informed European plumbers cannot imitate. The following account of the process by which the plates are formed was communicated to a writer in the Gentleman's Magazine by an intelligent officer of an East Indiamen. The caster sits by a pot containing the melted metal; and has two large stones, the under one fixed, the upper moveable, directly before him. He raises the upper stone by pressing his foot upon the side of it, and with an iron ladle pours in the opening a proper quantity of the fluid metal. He then immediately lets fall the upper stone, and by that means forms the lead into a thin irregular plate, which is afterwards cut into a proper shape. The surfaces of the stones, where they touch each other, are exactly ground together.

PLUMBUM, LEAD. See LEAD, CHEMISTRY *Index*.

PLUMBUM Corneum, or muriate of lead, a combination of lead with muriatic acid. See LEAD, CHEMISTRY *Index*.

PLUME, or PLUMULA, in *Botany*, the bud or germ. See GEMMA.

PLUMIER, CHARLES, a learned Minim, born at Marseilles, and one of the most able botanists of the 17th century. He was instructed by the famous Maignan, who taught him mathematics, turnery, the art of making spectacles, burning-glasses, microscopes, and other works. He at length went to Rome to perfect himself in his studies, and there applied himself entirely to botany under a skilful Italian. At his return to Provence, he settled in the convent at Bornes, a maritime place near Hieres, where he had the conveniency of making discoveries in the fields with respect to simples. He was some time after sent by the French king to America, to bring from thence such plants as might be of service in medicine. He made three different voyages to the Antilles, and visited the island of St Domingo. The king honoured him with a pension; and he at last settled at Paris. However, at the desire of M. Fagon, he prepared to go a fourth time to America, to examine the tree which produces the Jesuits bark; but died at the port of Santa Maria, near Cadiz, in 1706. He wrote several excellent works; the principal of which are, 1. A volume of the Plants in the American Islands. 2. A Treatise on the American Fern. 3. The Art of Turnery; a curious work embellished with plates.

PLUMMET, *PLUMB-Rule*, or *Plumb-line*, an instrument used by carpenters, masons, &c. in order to judge whether walls, &c. be upright planes, horizontal, or the like. It is thus called from a piece of lead, fastened to the end of a cord, which usually constitutes this instrument. Sometimes the string descends along a wooden ruler, &c. raised perpendicularly on another; in which case it becomes a level.

PLUMMING, among miners, is the method of using a mine-dial, in order to know the exact place of the work where to sink down an air-shaft, or to bring an adit to the work, or to know which way the load inclines when any flexure happens in it.

It is performed in this manner: A skilful person with an assistant, and with pen, ink, and paper, and a long line, and a mine-dial, after his guess of the place above ground, descends into the adit or work, and there fastens one end of the line to some fixed thing in it; then the incited needle is let to rest, and the exact point where it rests is marked with a pen: he then goes on farther in, the line still fastened, and at the next flexure of the adit he makes a mark on the line by a knot or otherwise: and then letting down the dial again, he there likewise notes down that point at which the needle stands in this second position. In this manner he proceeds, from turning to turning, marking down the points, and marking the line, till he comes to the intended place: this done, he ascends and begins to work on the surface of the earth what he did in the adit, bringing the first knot in the line to such a place where the mark of the place of the needle will again answer its pointing, and continues this till he come to the desired place above ground, which is certain to be perpendicular over the part of the mine into which the air-shaft is to be sunk.

PLUMOSE, something formed in the manner of a feather, with a stem and fibres issuing from it on each side; such are the antennæ of certain moths, butterflies, &c.

PLURAL, in *Grammar*, an epithet applied to that number of nouns and verbs which is used when we speak of more than one thing. See GRAMMAR.

PLURALITY, a discrete quality, consisting of two or a greater number of the same kind: thus we say, a plurality of gods, &c. See the article ASTRONOMY, N° 157. for the arguments both for and against a plurality of worlds.

Plurality of Benefices, or *Livings*, is where the same clerk is possessed of two or more spiritual preferments with cure of souls. See Benefice.

The smallness of some benefices first gave rise to pluralities; for an ecclesiastic, unable to subsist on a single one, was allowed to hold two; and at length the number increased without bounds. A remedy was attempted for this abuse at the council of Lateran under Alexander III. and Innocent III. in the year 1215, when the holding more than one benefice was forbid by a canon under the penalty of deprivation; but the same canon granting the pope a power to dispense with it in favour of persons of distinguished merit, the prohibition became almost useless. They were also restrained by statute 21 Hen. VIII. cap. 13. which enacts, that if any person having one benefice with cure of souls, of the yearly value of 8l. or above (in the king's books), accept any other with cure of souls, the first shall be adjudged in law to be void, &c. though the same statute provides for dispensation in certain cases.

In England, in order to procure a dispensation, the presentce must obtain of the bishop, in whose diocese the livings are, two certificates of the values in the king's books, and the reputed values and distance; one for the archbishop, and the other for the lord-chancellor. And if the livings lie in two dioceses, then two certificates of the same kind are to be obtained from each bishop. He must also show the archbishop his presentation to the second living; and bring with him two testimonials from the neighbouring clergy concerning his behaviour and conversation, one for the archbishop and the other for the lord-chancellor; and he must also show the archbishop his letters of orders, and a certificate of his having taken the degree of master of arts at the least, in one of the universities of this realm, under the hand of the register. And if he be not doctor or bachelor of divinity, nor doctor nor bachelor of law, he is to procure a qualification of a chaplain, which is to be duly registered in the faculty office, in order to be tendered to the archbishop, according to the statute. And if he hath taken any of the aforesaid degrees, which the statute allows as qualifications, he is to procure a certificate thereof as already mentioned, and to show the same to the archbishop; after which his dispensation is made out at the faculty office, where he gives security according to the direction of the canon. He must then repair to the lord-chancellor for confirmation under the broad seal; and he must apply to the bishop of the diocese where the living lies for his admission and institution. By the several stamp acts, for every skin, or paper, or parchment, &c. on which any dispensation to hold two ecclesiastical dignities or benefices, or a dignity and a benefice, shall be engrossed or written, there shall be paid a treble 40s. stamp duty.

We have also a regulation in regard to pluralities; but it is often dispensed with: for, by the faculty of dispensation, a pluralist is required, in that benefice from which he shall happen to be most absent, to preach 13 sermons every year, and to exercise hospitality for two months yearly.

In Germany the pope grants dispensation for possessing a plurality of benefices, on pretence that the ecclesiastical princes there need large revenues to bear up against the Protestant princes.

PLUS, in *Algebra*, a character marked thus +, used for the sign of addition. See Algebra.

PLUSH, in commerce, &c. a kind of stuff, having a sort of velvet knap or shag on one side, composed regularly of a woof of a single woollen thread and a double warp; the one wool, of two threads twisted; the other goats or camels hair; though there are some plushes entirely of worsted, and others composed wholly of hair.

PLUTARCH, a great philosopher and historian of antiquity, who lived from the reign of Claudius to that of Hadrian, was born at Chæronea, a small city of Bœotia in Greece. Plutarch's family was ancient in Chæronea: his grandfather Lamprias was eminent for his learning and a philosopher; and is often mentioned by Plutarch in his writings, as is also his father. Plutarch was initiated early in study, to which he was naturally inclined; and was placed under the care of Ammonius, an Egyptian, who, having taught philosophy with great reputation at Alexandria, from thence travelled into Greece, and settled at Athens. Under this master he made great advances in knowledge; and like a thorough philosopher, more apt to regard things than words, he pursued this knowledge, to the neglect of languages. The Roman language at that time was not only the language of Rome, but of Greece also: and much more used there than the French is now in England. Yet he was so far from regarding it then, that, as we learn from himself, he became not conversant in it till the declension of his life: and though he is supposed to have resided in Rome near 40 years at different times, yet he never seems to have acquired a competent skill in it. But this was not the worst: he did not cultivate his mother-tongue with any great exactness; and hence that harshness, inequality, and obscurity in his style, which has so frequently and so justly been complained of.

After he was principled and grounded by Ammonius, having an insatiable thirst for knowledge, he resolved to travel. Egypt was at that time, as formerly it had been, famous for learning; and probably the mysteriousness of their doctrine might tempt him, as it had tempted Pythagoras and others, to go and converse with the priesthood of that country. This appears to have been particularly his business, by his treatise *Of Isis and Osiris*: in which he shows himself versed in the ancient theology and philosophy of the wise men. From Egypt he returned into Greece; and visiting in his way all the academies and schools of the philosophers, gathered from them many of those observations with which he has abundantly enriched posterity. He does not seem to have been attached to any particular sect, but culled from each of them whatever he thought excellent and worthy to be regarded. He could not bear the paradoxes of the Stoics, but yet was more averse from the impiety of the Epicureans: in many things he followed Aristotle; but his favourites were Socrates and Plato, whose memory he revered so highly, that he annually celebrated their birth-days with much solemnity. Besides this, he applied himself with extreme diligence to collect not only all books that were excellent in their kind, but also all the sayings and observations of wise men which he had heard in conversation or had received from others by tradition; and likewise to consult the records and public instruments preserved in cities which he had visited in his travels. He took a particular journey to Sparta, to search the archives of that famous commonwealth, to understand thoroughly the model of their ancient government, the history of their legislators, their kings, and their ephori; and digested all their memorable deeds and sayings with much care. He took the same methods with regard to many other commonwealths; and thus was enabled to leave us in his works such a rich cabinet of observations upon men and manners, as, in the opinion of Montaigne and Bayle, have rendered him the most valuable author of antiquity.

The circumstances of Plutarch's life are not known, and therefore cannot be related with any exactness. According to the learned Fabricius, he was born under Claudius, 50 years after the Christian era. He was married to a most amiable woman of his own native town, whose name, according to the probable conjecture of Rualdus, was Timoxena, and to whose sense and virtue he has borne the most affectionate testimony in his moral works. He had several children, and among them two sons; one called *Plutarch* after himself, the other *Lamprias* in memory of his grandfather. Lamprias was he, of all his children, who seems to have inherited his fathers's philosophy; and to him we owe the table or catalogue of Plutarch's writings, and perhaps also his apophthegms. He had a nephew, Sextus Chæroneus, who taught the learned emperor Marcus Aurelius the Greek tongue, and was much honoured by him. Some think, that the critic Longinus was of his family; and Apuleius, in the first book of his Metamorphoses, affirms himself to be descended from him.

On what occasion, and at what time of his life, he went to Rome, how long he lived there, and when he finally returned to his own country, are all uncertain. It is probable, that the fame of him went thither before him, not only because he had published several of his works, but because immediately upon his arrival, as there is reason to believe, he had a great resort of the Roman nobility to hear him: for he tells us himself, that he was so taken up in giving lectures of philosophy to the great men of Rome, that he had not time to make himself master of the Latin tongue, which is one of the first things that would naturally have engaged his attention. It appears that he was several times at Rome; and perhaps one motive for his living there was the intimacy he had contracted in some of these journeys with Sossius Senecio, a great and worthy man, who had been four times consul, and to whom Plutarch has dedicated many of his lives. But the great inducement which carried him first to Rome, was undoubtedly that which had carried him into so many other parts of the world; namely, to make observations upon men and manners, and to collect materials for writing the lives of the Roman worthies, in the same manner as he had already written those of the Grecian: and accordingly he not only conversed with all the living, but searched the records of the Capitol, and of all the libraries. Not but, as we learn from Suidas, he was intrusted also with the management of public affairs in the empire, during his residence in the metropolis. "Plutarch (says he) lived in the time of Trajan, who bestowed on him the consular ornaments, and also caused an edict to be passed, that the magistrates or officers of Illyria should do nothing in that province without his knowledge and approbation."

When and how he was made known to Trajan is likewise uncertain: but it is generally supposed that Trajan, a private man when Plutarch first came to Rome, was, among other nobility, one of his auditors. It is also supposed, that this wise emperor made use of him in his councils; at least, much of the happiness of his reign has been imputed to Plutarch. Fabricius asserts that he was Trajan's preceptor, and that he was raised to the consular dignity by him, and made procurator of Greece in his old age by the emperor Adrian. We are equally at a loss concerning the time of his abode in the imperial city; which, however, at different times, is not imagined to fall much short of 40 years. The desire of visiting his native country, so natural to all men, and especially when growing old, prevailed with him at length to leave Italy: and at his return he was unanimously chosen archon or chief magistrate of Chæronea, and not long after admitted into the number of the Delphic Apollo's priests. We have no particular account of his death, either as to the manner of it or the year; only it is evident that he lived, and continued his studies, to a good old age. The most probable conjecture is that of Fabricius, who says he died in the fifth year of Adrian, at the age of 70.

His works have been divided, and they admit of a pretty equal division, into Lives and Morals: the former of which, in his own estimation, were to be preferred as more noble than the latter. His style, as we have already observed, has been excepted to with some reason: he has also been criticised for some mistakes in Roman antiquities, and for a little partiality to the Greeks. On the other hand, he has been justly praised for the copiousness of his fine sense and learning, for his integrity, and for a certain air of goodness which appears in all he wrote. His business was not to please the ear, but to instruct and charm the mind; and in this none ever went beyond him. Of his moral writings it is to be regretted that we have no elegant English translation. Even his Lives were chiefly known to the English reader by a motley and miserable version, till a new one executed with fidelity and spirit was presented to the public by the Langhornes in 1770. On the whole, it is to be wished that this most amiable moralist and biographer had added a life of himself to those which he has given to the world of others, as the particulars which other writers have preserved of his personal history are very doubtful and imperfect.

PLUTO, in Pagan worship, the king of the infernal regions, was the son of Saturn and Ops, and the brother of Jupiter and Neptune. This deity finding himself childless and unmarried, mounted his chariot to visit the world; and arriving in Sicily, fell in love with Proserpine, whom he saw gathering flowers with her companions in the valley of Enna, near Mount Ætna: when, forcing her into his chariot, he drove her to the river Chemarus, through which he opened himself a passage back to the realms of night. See CERES and PROSERPINE.

Pluto is usually represented in an ebony chariot drawn by four black horses; sometimes holding a sceptre, to denote his power; at others, a wand, with which he drives away the ghosts; and at others, some keys, to signify that he had the keys of death. Homer observes, that his helmet had the quality of rendering the wearer invisible, and that Minerva borrowed it in order to be concealed from Mars when she fought against the Trojans. Pluto was greatly revered both by the Greeks and Romans, who erected temples and altars to him. To this god sacrifices were offered in the night, and it was not lawful to offer them by day.

PLUTUS, in Pagan worship, the god of riches, is frequently confounded with Pluto. He was represented as appearing lame when he approached, and with wings at his departure; to show the difficulty of amassing wealth and the uncertainty of its enjoyment. He was also frequently represented blind, to show that he often bestowed his favours on the most unworthy, and left in necessity those who had the greatest merit.

PLUVIALIS, a species of plover. See CHARADRIUS, ORNITHOLOGY *Index*.

PLUVIUS, a surname of Jupiter. He was invoked by that name among the Romans whenever the earth was parched up by continual heat, and was in want of refreshing rains. He had an altar in the temple on the capitol.

PLYERS, in fortification, denote a kind of balance used in raising or letting down a draw-bridge. They consist of two timber levers, twice as long as the bridge they lift, joined together by other timbers framed in the form of a St Andrew's cross to counterpoise them. They are supported by two upright jams, on which they swing; and the bridge is raised or let down by means of chains joining the ends of the plyers and bridge.

PLYING, in the sea language, the act of making, or endeavouring to make, a progress against the direction of the wind. Hence a ship that advances well in her course in this manner of sailing, is said to be a good plyer. See the articles BEATING, PITCHING, and TACKING.

PLYMOUTH, a town of Devonshire, in England, about 215 miles from London, stands between the rivers Plym and Tamar, just before they fall into the British channel. From a mere fishing village it has become one of the largest towns in the county; and is one of the chief magazines in the kingdom, on account of its port, which is one of the safest in England, and which is so large as to be able to contain 1000 sail. It is defended by several different forts, mounting altogether nearly 300 guns; of which the chief is the Royal Citadel erected in the reign of Charles II. opposite to St Nicholas island, which is within the circuit of its walls, and contains a large store-house and five regular bastions. In time of war the outward-bound convoys generally rendezvous at Plymouth, and homeward-bound ships generally put in to provide pilots up the Channel. It is also a place of resort for men of war that are windbound. It contained 56,000 inhabitants in 1811.

The mouth of the Tamar is called Ham-Ooze, and that of Plym Catwater, which are both commanded by the castle on St Nicholas island. About two miles up the mouth of the Tamar there are four docks, two of which were built in the reign of William III. one wet and the other dry, and two which have been built since. They have every conveniency for building or repairing ships. One of the docks is hewn out of a mine of slate, and lined with Portland stone. This town enjoys a pilchard fishery of considerable importance, and carries on an extensive trade with Newfoundland and the Straits. There is a customhouse in it; and though there are two churches (and besides several meeting-houses), yet each church has so large a cure of souls, that the parish clerks were till very lately in deacons orders, to enable them to perform all the occasional and other offices. The seat-rents are given to the poor. The lecturers are chosen every three years by the corporation, which was constituted by Henry VI. and consists of a mayor, 12 aldermen, and 24 common-council men. The mayor is elected by a jury of 36 persons, chosen by four others, two of whom are appointed by the mayor and aldermen, and the other two by the common-council. There is also a recorder and a town-clerk. The population in 1801 exceeded 43,000. The town consists of four divisions, which were anciently governed by four captains, each of whom had three constables under him. It is well supplied with fresh water, which was brought from the distance of seven miles, by Sir Francis Drake a native of the town. The toll of the markets and of the cotton, yarn, &c. with the profit of the mill, which is very considerable, belongs to the corporation, as do the revenues of the shambles, which are farmed out for the mayor's kitchen. There is a charity school in Plymouth, four hospitals, and a workhouse, in all which 100 poor children are clothed, fed, and taught; and there are two printing-houses. To one of the hospitals Colonel Jory gave a charity for 12 poor widows, as he did a mace worth 120l. to be carried before the mayor, and six good bells, valued at 500l. to Charles-Church, so called from our kings in whose reigns it was begun and finished. In the entrace of the bay lies the famous Eddystone rock, which is covered at high water, and on which the ingenious Mr Winstanley built a light-house, that was blown down in the terrible hurricane of Nov. 27th 1703, and himself, with others that were with him in it, never more heard of. However, another was erected in the room of it, by the corporation of the Trinity-house, in the time of Queen Anne, which was destroyed by an accidental fire Dec. 4th 1755, but rebuilt in 1759: which was also burnt down, and rebuilt by the celebrated Smeaton in the year 1770. In the reign of Edward III. the French landed, and burnt part of the town, but were soon repulsed by Hugh Courtenay earl of Devon. In the reign of Henry IV. the French landed here again, and burnt 600 houses. Between this town and the sea is a hill called the Haw, which has a delightful plain on the top, having a pleasant prospect all round it, and a good landmark for the use of mariners. The list of parliament-men for this borough, formerly divided into two parts, by the names of Sutton-Valtort and Sutton-Prior, commences the 26th of Edward I. and continues to the 14th of Edward III. after which we find no return made for it till the 20th of Henry VI. when the privilege was renewed. On the Haw is a fort, which at once commands the town and defends the harbour. Here is a ferry over the Tamar, called Crumwell or Crimble Passage, the west side of which is called Westone-House, and is in Devonshire, though most of the parish wherein it stands is in Cornwall. In April 1759 parliament granted 25,159l. for the better fortifying the town and dock of Plymouth. N. Lat. 50. 26. W. Long. 4. 15.

PLYMOUTH, in New England, a sea-port town, and capital of the county of the same name, in the province of Massachusets Bay, in North America, with about 2000 inhabitants. It is remarkable for having been the first settlement in New England, and for having had the first place of worship. It is seated at the south end of Plymouth bay. W. Long. 70. 40. N. Lat. 41. 58.

PLYNTERIA, a Grecian festival in honour of Aglauros, or rather of Minerva, who received from the daughter of Cecrops the name of Aglauros. The word is derived from πλυνειν, *lavare*, because during the solemnity they undressed the statue of the goddess and washed it. The day on which it was observed was looked upon as unfortunate and inauspicious; and therefore no person was permitted to appear in the temples, as they were purposely surrounded with ropes. The arrival of Alcibiades in Athens that day was thought very unfortunate, but the success that ever after attended him proved it to be otherwise. It was customary at this festival to bear in procession a cluster of figs; which intimated the progress of civilization among the first inhabitants of the earth, as figs served them for food after they had found a dislike for acorns.

PNEUMATICS.

1 Definition of the term.

THIS term is restricted, in the present habits of our language, to that part of natural philosophy which treats of the mechanical properties of elastic fluids. The word, in its original meaning, expresses a quality of air, or more properly of breath. Under the article PHYSICS we observed, that in a great number of languages the term used to express breath was also one of the terms used to express the animating principle, nay, the intellectual substance, the soul. It has been perhaps owing to some attention to this chance of confusion that our philosophers have appropriated the term PNEUMATICS to the science of the mechanical properties of air, and PNEUMATOLOGY to the science of the intellectual phenomena consequent on the operations or affections of our thinking principle.

2 Extent of the science.

We have extended (on the authority of present custom) the term PNEUMATICS to the study of the mechanical properties of all elastic or sensibly compressible fluids, that is, of fluids whose elasticity and compressibility become an interesting object of our attention; as the term HYDROSTATICS is applied to the study of the mechanical properties of such bodies as interest us by their fluidity or liquidity only, or whose elasticity and compressibility are not familiar or interesting, though not less real or general than in the case of air and all vapours.

3 No precise limit to the different classes of bodies.

We may be indulged in the observation by the bye, that there is no precise limit to the different classes of natural bodies with respect to their mechanical properties. There is no such thing as a body perfectly hard, perfectly soft, perfectly elastic, or perfectly incompressible. All bodies have some degree of elasticity intermixed with some degree of ductility. Water, mercury, oil, are compressible; but their compressibility need not be attended to in order perfectly to understand the phenomena consequent on their materiality, fluidity, and gravity. But if we neglect the compressibility of air, we remain ignorant of the cause and nature of its most interesting phenomena, and are but imperfectly informed with respect to those in which its elasticity has no share; and it is convenient to attend to this distinction in our researches, in order to understand those phenomena which depend solely or chiefly on compressibility and elasticity. This observation is important; for here elasticity appears in its most simple form, unaccompanied with any other mechanical affection of matter (if we except gravity), and lies most open to our observation, whether employed for investigating the nature of this very property of bodies, or for explaining its mode of action. We shall even find that the constitution of an avowedly elastic fluid, whose compressibility is so very sensible, will give us the distinctest notions of fluidity in general, and enable us to understand its *characteristic appearances*, by which it is distinguished from solidity, namely, the *equable* distribution of pressure through all its parts in every direction, and the horizontality which its surface assumes by the action of gravity: phenomena which have been assumed as equivalent to the definition of a perfect fluid, and from which all the laws of hydrostatics and hydraulics have been derived. And these laws have been applied to the explanation of the phenomena around us; and water, mercury, oil, &c. have been denominated fluid only because their appearances have been found to tally exactly with these consequences of this definition, while the definition itself remains in the form of an assumption, unsupported by any other proof of its obtaining in nature. A real mechanical philosopher will therefore attach himself with great eagerness to this property, and consider it as an introduction to much natural science.

4 Air the most fa- liar com- pressible fluid.

Of all the sensible compressible fluids air is the most familiar, was the first studied, and the most minutely examined. It has therefore been generally taken as the example of their mechanical properties, while those mechanical properties which are peculiar to any of them, and therefore characteristic, have usually been treated as an appendix to the general science of pneumatics. No objection occurs to us against this method, which will therefore be adopted in treating this article.

5 Different properties of it.

But although the mechanical properties are the proper subjects of our consideration, it will be impossible to avoid considering occasionally properties which are more of a chemical nature; because they occasion such modifications of the mechanical properties as would frequently be unintelligible without considering them in conjunction with the other; and, on the other hand, the mechanical properties produce such modifications of the properties merely chemical, and of very interesting phenomena consequent on them, that these would often pass unexplained unless we give an account of them in this place.

6 Mechani- cal proper- ties.

By *mechanical properties* we would be understood to mean such as produce, or are connected with, sensible changes of motion, and which indicate the presence and agency of moving or mechanical powers. They are therefore the subject of mathematical discussion; admitting of measure, number, and direction, notions purely mathematical.

We shall therefore begin with the consideration of air.

7
Vhat is ir?

It is by no means an idle question, "*What is this* air of which so much is said and written?" We see nothing, we feel nothing. We find ourselves at liberty to move about in any direction without any let or hinderance. Whence, then, the assertion, that we are surrounded with a *matter* called air? A few very simple observations and experiments will shew us that this assertion is well founded.

8
roofs hat it is atter.
Plate cccxxiii. fig. 1.

We are accustomed to say that a vessel is empty when we have poured out of it the water which it contained. Take a cylindrical glass jar (fig 1.) having a small hole in its bottom; and having stopped this hole, fill the jar with water, and then pour out the water, leaving the glass empty, in the common acceptation of the word. Now, throw a bit of cork, or any light body, on the surface of water in a cistern: cover this with the glass jar A held in the hand with its bottom upwards, and move it downwards, as at B, keeping it all the while in an upright position. The cork will continue to float on the surface of the water in the inside of the glass, and will most distinctly shew whereabouts that surface is. It will thus be seen that the water within the glass has its surface considerably lower at C than that of the surrounding water; and however deep we immerge the glass, we shall find that the water will never rise in the inside of it so as to fill it. If plunged to the depth of 32 feet, the water will only half fill it; and yet the acknowledged laws of hydrostatics tell us, that the water would fill the glass if there were nothing to hinder it. There is therefore something already within the glass which prevents the water from getting into it; manifesting in this manner the most distinctive property of matter, viz. the hindering other matter from occupying the same place at the same time.

9
ssessed of pulsive rce,

While things are in this condition, pull the stopper D out of the hole in the bottom of the jar, and the water will instantly rise in the inside of the jar, and stand at an equal height within and without. This is justly ascribed to the escape through the hole of the *matter* which formerly obstructed the entry of the water; for if the hand be held before the hole, a puff will be distinctly felt, or a feather held there will be blown aside; indicating in this manner that what prevented the entry of the water, and now escapes, possesses another characteristic property of matter, *impulsive force*. The materiality is concluded from this appearance in the same manner that the materiality of water is concluded from the impulse of a jet from a pipe. We also see the mobility of the formerly pent up, and now liberated, substance, in consequence of external pressure, viz. the pressure of the surrounding water.

10
enetra- ty,

Also, if we take a smooth cylindrical tube, shut at one end, and fit a plug or cork to its open end, so as to slide along it, but so tightly as to prevent all passage by its sides; and if the plug be well soaked in grease, we shall find that no force whatever can push it to the bottom of the tube. There is therefore *something* within the tube preventing by its impenetrability the entry of the plug, and therefore possessing this characteristic of matter.

11
ticity,

In like manner, if, after having opened a pair of common bellows, we shut up the nozzle and valve hole, and try to bring the boards together, we find it impossible. There is something included which prevents this, in the same manner as if the bellows were filled with wool; but on opening the nozzle we can easily shut them. viz. by expelling this something; and if the compression be forcible, the something will issue with considerable force, and very sensibly impel any thing in its way.

12
Inertia, and mobility.

It is not accurate to say, that we move about without *any* obstruction: for we find, that if we endeavour to move a large fan with rapidity, a very sensible hinderance is perceived, and that a very sensible force must be exerted; and a sensible wind is produced, which will agitate the neighbouring bodies. It is therefore justly concluded that the motion is possible only in consequence of having driven this obstructing substance out of the way: and that this impenetrable, resisting, moveable, impelling substance, is *matter*. We perceive the perseverance of this matter in its state of rest when we wave a fan, in the same manner that we perceive the *inertia* of water when we move a paddle through it. The effects of wind in impelling our ships and mills, in tearing up trees, and overturning buildings, are equal indications of its perseverance in a state of motion.

To this matter, when at rest, we give the name AIR; and when it is in motion we call it WIND.

13
It is therefore a material fluid,

Air, therefore, is a material fluid: a fluid, because its parts are easily moved, and yield to the smallest inequality of pressure.

14
Heavy, and

Air possesses some others of the very general, though not essential properties of matter. It is heavy. This appears from the following facts.

1. It always accompanies this globe in its orbit round the sun, surrounding it to a certain distance, under the name of the ATMOSPHERE, which indicates the being connected with the earth by its general force of gravity. It is chiefly in consequence of this that it is continually moving round the earth from east to west; forming what is called the trade-wind, to be more particularly considered afterwards. All that is to be observed on this subject at present is, that, in consequence of the disturbing force of the sun and moon, there is an accumulation of the air of the atmosphere, in the same manner as of the waters of the ocean, in those parts of the globe which have the moon near their zenith or nadir: and as this happens successively, going from the east to the west (by the rotation of the earth round its axis in the opposite direction), the accumulated air must gradually flow along to form the elevation. This is chiefly to be observed in the torrid zone; and the generality and regularity of this motion are greatly disturbed by the changes which are continually taking place in different parts of the atmosphere from causes which are not mechanical.

15
supports the clouds

2. It is in like manner owing to the gravity of the air that it supports the clouds and vapours which we see constantly floating in it. We have even seen bodies of no inconsiderable weight float, and even rise in the air. Soap bubbles, and balloons filled with inflammable gas, rise and float in the same manner as a cork rises in water. This phenomenon proves the weight of the air, in the same manner that the swimming of a piece of wood indicates the weight of the water which supports it.

16
Familiar proofs of its weight.

3. But we are not left to these refined observations

for the proof of the air's gravity. We may observe familiar phenomena, which would be immediate consequences of the supposition that air is a heavy fluid, and like other heavy fluids, presses on the outsides of all bodies immersed in or surrounded by it. Thus, for instance, if we shut the nozzle and valve hole of a pair of bellows after having squeezed the air out of them, we shall find that a very great force, even some hundred pounds, is necessary for separating the boards. They are kept together by the pressure of the heavy air which surrounds them, in the same manner as if they were immersed in water. In like manner if we stop the end of a syringe after its piston has been pressed down to the bottom, and then attempt to draw up the piston, we shall find a considerable force necessary, viz. about 15 or 16 pounds for every square inch of the section of the syringe. Exerting this force, we can draw up the piston to the top, and we can hold it there; but the moment we cease acting, the piston rushes down and strikes the bottom. It is called a suction, as we feel something as it were drawing in the piston; but it is really the weight of the incumbent air pressing it in. And this obtains in every position of the syringe; because the air is a fluid, and presses in every direction. Nay, it presses on the syringe as well as on the piston; and if the piston be hung by its ring on a nail, the syringe requires force to draw it down (just as much as to draw the piston up); and if it be let go, it will spring up, unless loaded with at least 15 pounds for every square inch of its transverse section (see fig. 2.).

Plate ccccxxiii. fig. 2.

17
It may even be weighed.

4. But the most direct proof of the weight of the air is had by weighing a vessel empty of air, and then weighing it again when the air has been admitted; and this, as it is the most obvious consequence of its weight, has been asserted as long ago as the days of Aristotle. He says (Περὶ Ουρανου, iv. 4.), That all bodies are heavy in their place except fire; even air is heavy; for a blown bladder is heavier than when it is empty. It is somewhat surprising that his followers should have gone into the opposite opinion, while professing to maintain the doctrine of their leader. If we take a very large and limber bladder, and squeeze out the air very carefully, and weigh it, and then fill it till the wrinkles just begin to disappear, and weigh it again, we shall find no difference in the weight. But this is not Aristotle's meaning; because the bladder, considered as a vessel, is equally full in both cases, its dimensions being changed. We cannot take the air out of a bladder without its immediately collapsing. But what would be true of a bladder would be equally true of any vessel. Therefore, take a round vessel A (fig. 3.), fitted with a stopcock B, and syringe C. Fill the whole with water, and press the piston to the bottom of the syringe. Then keeping the cock open, and holding the vessel upright, with the syringe undermost, draw down the piston. The water will follow it by its weight, and leave part of the vessel empty. Now shut the cock, and again push up the piston to the bottom of the syringe; the water escapes through the piston valve, as will be explained afterward: then opening the cock, and again drawing down the piston, more water will come out of the vessel. Repeat this operation till all the water have come out. Shut the cock, unscrew the syringe, and weigh the vessel very accurately. Now open the cock, and admit the air, and weigh the vessel again, it will be found heavier than before, and this additional weight is the weight of the air which fills it; and it will be found to be 523 grains, about an ounce and a fifth avoirdupois, for every cubic foot that the vessel contains. Now since a cubic foot of water would weigh 1000 ounces, this experiment would show that water is about 840 times heavier than air. The most accurate judgment of this kind of which we have met with an account is that recorded by Sir George Shuckburgh, which is in the 67th vol. of the Philosophical Transactions, p. 560. From this it follows, that when the air is of the temperature 53, and the barometer stands at $29\frac{1}{4}$ inches, the air is 836 times lighter than water. But the experiment is not susceptible of sufficient accuracy for determining the exact weight of a cubic foot of air. Its weight is very small; and the vessel must be strong and heavy, so as to overload any balance that is sufficiently nice for the experiment.

Fig. 3.

18
The most convenient method of doing this.

To avoid this inconvenience, the whole may be weighed in water, first loading the vessel so as to make it preponderate an ounce or two in the water. By this means the balance will be loaded only with this small preponderancy. But even in this case there are considerable sources of error, arising from changes in the specific gravity of the water and other causes. The experiment has often been repeated with this view, and the air has been found at a medium to be about 840 times as light as water, but with great variations, as may be expected from its very heterogeneous nature, in consequence of its being the menstruum of almost every fluid, of all vapours, and even of most solid bodies; all which it holds in solution, forming a fluid perfectly transparent, and of very different density according to its composition. It is found, for instance, that perfectly pure air of the temperature of our ordinary summer is considerably denser than when it has dissolved about half as much water as it can hold in that temperature; and that with this quantity of water the difference of density increases in proportion as the mass grows warmer, for damp air is more expansible by heat than dry air. We have had occasion to consider this subject when treating of the connection of the mechanical properties of air with the state of the weather. See METEOROLOGY.

19
This property of air denied by the Peripatetics though acknowledged by their master.

Such is the result of the experiment suggested by Aristotle, evidently proving the weight of the air; and yet, as has been observed, the Peripatetics, who profess to follow the *dictates* of Aristotle, uniformly refused it this property. It was a matter long debated among the philosophers of the last century. The reason was that Aristotle, with that indistinctness and inconsistency, which is observed in all his writings which relate to matters of fact and experience, assigns a different cause to many phenomena which any man led by common observation would ascribe to the weight of the air. Of this kind is the rise of water in pumps and syphons, which all the Peripatetics had for ages ascribed to something which they called *nature's abhorrence of a void*. Aristotle had asserted (for reasons not our business to adduce at present), that all nature was full of being, and that nature abhorred a void. He adduces many facts, in which it appears, that if not absolutely impossible, it is very difficult and requires great force, to produce a space void of matter. When the operation of pumps and syphons came to be known, the philosophers of Europe (who had all embraced the Peripatetic doctrines)

doctrines) found in this fancied horror of a fancied mind (what else is this that nature abhors?) a ready solution of the phenomena. We shall state the facts, that every reader may see what kinds of reasoning were received among the learned not two centuries ago.

20
Construction of pumps in the last century. Fig. 4.

Pumps were then constructed in the following manner: A long pipe GB (fig. 4.) was set in the water of the well A. This was fitted with a sucker or piston C, having a long rod CF, and was furnished with a valve B at the bottom, and a lateral pipe DE at the place of delivery, also furnished with a valve. The fact is, that if the piston be thrust down to the bottom, and then drawn up, the water will follow it; and upon the piston being again pushed down, the water shuts the valve B by its weight, and escapes or is expelled at the valve E; and on drawing up the piston again the valve E is shut, the water again rises after the piston, and is again expelled at its next descent.

21
Their operation accounted for by the Peripatetics.

The Peripatetics explain all this by saying, that if the water did *not follow the piston* there would be a void between them. But nature abhors a void; or a void is impossible: therefore the water follows the piston.—It is not worth while to criticise the wretched reasoning in this pretence to explanation. It is all overturned by one observation. Suppose the pipe shut at the bottom, the piston *can* be drawn up, and thus a void produced. No, say the Peripatetics; and they speak of certain spirits, effluvia, &c. which occupy the place. But if so, why needs the water rise? This therefore is not the cause of its ascent. It is a curious and important phenomenon.

22
Galileo first accounted for it rationally.

The sagacious Galileo seems to have been the first who seriously ascribed this to the weight of the air. Many before him had supposed air heavy; and thus explained the difficulty of raising the board of bellows, or the piston of a syringe, &c. But he distinctly applies to this allowed weight of the air all the consequences of hydrostatical laws; and he reasons as follows.

23
by the weight of the atmosphere,

The heavy air rests on the water in the cistern, and presses it with its weight. It does the same with the water in the pipe, and therefore both are on a level: but if the piston, after being in contact with the surface of the water, be drawn up, there is no longer any pressure on the surface of the water within the pipe; for the air now rests on the piston only, and thus occasions a difficulty in drawing it up. The water in the pipe, therefore, is in the same situation as if more water were poured into the cistern, that is, as much as would exert the same pressure on its surface as the air does. In this case we are certain that the water will be pressed into the pipe, and will raise up the water already in it, and follow it till it is equally high within and without. The same pressure of the air shuts the valve E during the descent of the piston. (See *Gal. Discourses*).

24
and predicted the height to which water would rise in them.

He did not wait for the very obvious objection, that if the rise of the water was the effect of the air's pressure, it would also be its measure, and would be raised and supported only to a certain height. He directly said so, and adduced this as a decisive experiment. If the horror of a void be the cause, says he, the water must rise to any height however great; but if it be owing to the pressure of the air, it will only rise till the weight of the water in the pipe is in equilibrio with the pressure of the air, according to the common laws of hydrostatics. And he adds, that this is well known; for it is a fact, that pumps will not *draw* water much above forty palms, although they may be made to *propel* it, or to *lift it* to any height. He then makes an assertion, which, if true, will be decisive. Let a very long pipe, shut at one end, be filled with water, and let it be erected perpendicularly with the close end uppermost, and a stopper in the other end, and then its lower orifice immersed into a vessel of water; the water will subside in the pipe upon removing the stopper, till the remaining column is in equilibrio with the pressure of the external air. This experiment he proposes to the curious; saying, however, that he thought it unnecessary, there being already such abundant proofs of the air's pressure.

25
His prediction verified by Toricelli's experiment.

It is probable that the cumbersomeness of the necessary apparatus protracted the making of this experiment. Another equally conclusive, and much easier, was made in 1642 after Galileo's death, by his zealous and learned disciple Toricelli. He filled a glass tube, close at one end, with mercury; judging, that if the support of the water was owing to the pressure of the air, and was the measure of this pressure, mercury would in like manner be supported by it, and this at a height which was also the measure of the air's pressure, and therefore 13 times less than water. He had the pleasure of seeing his expectation verified in the completest manner; the mercury descending in the tube AB (fig. 5.), and finally settling at the height *f* B of 29½ Roman inches: and he found, that when the tube was inclined, the point *f* was in the same horizontal plane with *f* in the upright tube, according to the received laws of hydrostatical pressure. The experiment was often repeated, and soon became famous, exciting great controversies among the philosophers about the possibility of a vacuum. About three years afterwards the same experiment was published, at Warsaw in Poland, by Valerianus Magnus, as his own suggestion and discovery: but it appears plain from the letters of Roberval, not only that Toricelli was prior, and that his experiment was the general topic of discussion among the curious; but also highly probable that Valerianus Magnus was informed of it when at Rome, and daily conversant with those who had seen it. He denies, however, even having heard of the name of Toricelli.

Fig. 5.

This was the era of philosophical ardour; and we think that it was Galileo's invention and immediate application of the telescope which gave it vigour. Discoveries of the most wonderful kind in the heavens, and which required no extent of previous knowledge to understand them, were thus put into the hands of every person who could purchase a spy-glass; while the high degree of credibility which some of the discoveries, such as the phases of Venus and the rotation and satellites of Jupiter, gave to the Copernican system, immediatly set the whole body of the learned in motion. Galileo joined to his ardour a great extent of learning, particularly of mathematical knowledge and sound logic, and was even the first who formally united mathematics with physics; and his treatise on accelerated motion was the first, and a precious fruit of this union. About the years 1642 and 1644, we find clubs of gentlemen associated in Oxford and London for the cultivation of knowledge by experiment; and before 1655 all the doctrines of hydrostatics and pneumatics were familiar there, established upon experiment. Mr Boyle procured a coalition and correspondence of these clubs under the name of the Invisible and Philosophical Society. In May 1658, Mr Hooke finished for Mr Boyle

26
Origin of the Royal Society, &c.

27
Invention of the air-pump.

28
The experiments of Galileo and Toricelli rapidly diffused.

Boyle an air-pump, which had employed him a long time, and occasioned him several journeys to London for things which the workmen of Oxford could not execute. He speaks of this as a great improvement on Mr Boyle's own pump, which he had been using some time before. Boyle therefore must have invented his air-pump, and was not indebted for it to Schottus's account of Otto Guerick's, published in his (Schottus) *Mechanica Hydraulo-pneumatica* in 1657, as he asserts (*Techna Curiosa*). The Royal Society of London arose in 1656 from the coalition of these clubs, after 15 years co-operation and correspondence. The Montmorine Society at Paris had subsisted nearly about the same time; for we find Paschal in 1648 speaking of the meetings in the Sorbonne College, from which we know that society originated.—Nuremberg, in Germany, was also a distinguished seminary of experimental philosophy. The magistrates, sensible of its valuable influence in many manufactures, the source of the opulence and prosperity of their city, and many of them philosphers, gave philosophy a professed and munificent patronage, furnishing the philosophers with a copious apparatus, a place of assembly, and a fund for the expence of their experiments; so that this was the first academy of sciences out of Italy under the patronage of government. In Italy, indeed, there had long existed institutions of this kind. Rome was the centre of church-government, and the resort of all expectants for preferment. The clergy was the majority of the learned in all Christian nations, and particularly of the systematic philosophers. Each, eager to recommend himself to notice, brought forward every thing that was curious; and they were the willing vehicles of philosophical communication. Thus the experiments of Galileo and Toricelli were rapidly diffused by persons of rank, the dignitaries of the church, or by the monks their obsequious servants. Perhaps the recent defection of England, and the want of a residing embassy at Rome, made her sometimes late in receiving or spreading philosophical researches, and was the cause that more was done there *proprio Marte*.

29
The merit of Toricelli's claimed by others

We hope to be excused for this digression. We were naturally led into it by the pretensions of Valerianus Magnus to originality in the experiment of the mercury supported by the pressure of the air. Such is the strength of national attachment, that there were not wanting some who found that Toricelli had borrowed his experiment from Honoratus Fabri, who had proposed and explained it in 1641: but whoever knows the writings of Toricelli, and Galileo's high opinion of him, will never think that he could need such helps. (See this surmise of Mounier in *Schott. Tech. Cur.* III. at the end).

Galileo must be considered as the author of the experiment when he proposes it to be made. Valerianus Magnus owns himself indebted to him for the principle and the contrivance of the experiment. It is neither wonderful that many ingenious men, of one opinion, and instructed by Galileo, should separately hit on so obvious a thing; nor that Toricelli, his immediate disciple, his enthusiastic admirer, and who was in the habits of corresponding with him till his death in 1642, should be the first to put it in practice. It became the subject of dispute from the national arrogance and self-conceit of some Frenchmen, who have always shown themselves disposed to consider their nation as at the head of the republic of letters, and cannot brook the concurrence of any foreigners. Roberval was in this instance, however, the champion of Toricelli; but those who know his controversies with the mathematicians of France at this time will easily account for this exception.

30
unjustly.

All now agree in giving Toricelli the honour of the *first* invention; and it universally passes by the name of the TORICELLIAN EXPERIMENT. The tube is called the TORICELLIAN TUBE; and the space left by the mercury is called the TORICELLIAN VACUUM, to distinguish it from the BOYLEAN VACUUM, which is only an extreme rarefaction.

31
It was repeated in various forms.

The experiment was repeated in various forms, and with apparatus which enabled philosophers to examine several effects which the vacuum produced on bodies exposed in it. This was done by making the upper part of the tube terminate in a vessel of some capacity, or communicate with such a vessel, in which were included along with the mercury bodies on which the experiments were to be made. When the mercury had run out, the phenomena of these bodies were carefully observed.

32
An objection to the conclusion drawn from it obviated.

An objection was made to the conclusion drawn from Toricelli's experiment, which appears formidable. If the Toricellian tube be suspended on the arm of a balance, it is found that the counterpoise must be equal to the weight both of the tube and of the mercury it contains. This could not be, say the objectors, if the mercury were supported by the air. It is evidently supported by the balance; and this gave rise to another notion of the cause different from the peripatetic *fuga vacui*: a suspensive force, or rather attraction, was assigned to the upper part of the tube.

But the true explanation of the phenomenon is most easy and satisfactory. Suppose the mercury in the cistern and tube to freeze, but without adhering to the tube, so that the tube could be freely drawn up and down. In this case the mercury is supported by the base, without any dependence on the pressure of the air; and the tube is in the same condition as before, and the solid mercury performs the office of a piston to this kind of syringe. Suppose the tube thrust down till the top of it touches the top of the mercury. It is evident that it must be drawn up in opposition to the pressure of the external air, and it is precisely similar to the syringe mentioned in N° 16. The weight sustained therefore by this arm of the balance is the weight of the tube and the downward pressure of the atmosphere on its top.

33
Galileo's original experiment performed.

The curiosity of philosophers being thus excited by this very manageable experiment, it was natural now to try the original experiment proposed by Galileo. Accordingly Berti in Italy, Paschal in France, and many others in different places, made the experiment with a tube filled with water, wine, oil, &c. and all with the success which might be expected in so simple a matter: and hence the doctrine of the weight and pressure of the air was established beyond contradiction or doubt. All this was done before the year 1648.—A very beautiful experiment was exhibited by Auzout, which completely satisfied all who had any remaining doubts.

34
An experiment by Auzout
Fig. 6.

A small box or phial EFGH (fig. 6.) had two glass tubes, AB, CD, three feet long, inserted into it in such a manner as to be firmly fixed in one end, and to reach nearly to the other end. AB was open at both ends, and CD was close at D. This apparatus was completely filled with mercury, by unscrewing the tube AB, filling the box, and the tube CD; then screwing in the tube AB, and filling it: then holding a finger on the orifice A, the whole was inverted and set upright in the position represented in figure *β*, immersing the orifice A (now *a* of fig. *β*.) in a small vessel of quicksilver. The result was, that the mercury ran out at the orifice *a*, till its surface *m n* within the phial descended to the top of the tube *b a*. The mercury also began to descend in the tube *d c* (formerly DC) and run over into the tube *b a*, and run out at *a*, till the mercury in *d c* was very near equal in a level with *m n*. The mercury descending in *b a*, till it stood at *k*, $29\frac{1}{2}$ inches above the surface *o p* of the mercury in the cistern, just as in the Toricellian tube.

The rationale of this experiment is very easy. The whole apparatus may first be considered as a Toricellian tube of an uncommon shape, and the mercury would flow out at *a*. But as soon as a drop of mercury comes out, leaving a space above *m n*, there is nothing to keep up the mercury in the tube *d c*. Its mercury therefore descends also; and running over into *b a*, continues to supply its expence till the tube *d c* is almost empty, or can no longer supply the waste of *b a*. The inner surface therefore falls as low as it can, till it is level with *b*. No more mercury can enter *b a*, yet its column is too heavy to be supported by the pressure of the air on the mercury in the cistern below; it therefore descends in *b a*, and finally settles at the height *h o*, equal to that of the mercury in the Toricellian tube.

35
decisive of the question.

The prettiest circumstance of the experiment remains. Make a small hole *g* in the upper cap of the box. The external air immediately rushes in by its weight, and now presses on the mercury in the box. This immediately raises the mercury in the tube *d c* to *l*, $29\frac{1}{2}$ inches above *m n*. It presses on the mercury at *k* in the tube *b a*, balancing the pressure of the air in the cistern. The mercury in the tube therefore is left to the influence of its own weight, and it descends to the bottom. Nothing can be more apposite or decisive.

36
The gravity of the air therefore a statical principle from which we obtain

And thus the doctrine of the gravity and pressure of the air is established by the most unexceptionable evidence: and we are intitled to assume it as a statical principle, and to affirm *à priori* all its legitimate consequences.

And in the first place, we obtain an exact measure of the pressure of the atmosphere. It is precisely equal to the weight of the column of mercury, of water, of oil, &c. which it can support; and the Toricellian tube, or others fitted up upon the same principle, are justly termed *baroscopes* and *barometers* with respect to the air.

37
an exact measure of the pressure of the atmosphere.

Now it is observed that water is supported at the height of 32 feet nearly: the weight of the column is exactly 2000 avoirdupois pounds on every square foot of base, or $13\frac{9}{10}$ on every square inch. The same conclusion very nearly may be drawn from the column of mercury, which is nearly $29\frac{1}{2}$ inches high when in equilibrium with the pressure of the air. We may here observe, that the measure taken from the height of a column of water, wine, spirits, and the other fluids of considerable volatility, as chemists term it, is not so exact as that taken from mercury, oil, and the like. For it is observed, that the volatile fluids are converted by the ordinary heat of our climates into vapour when the confining pressure of the air is removed; and this vapour, by its elasticity, exerts a small pressure on the surface of the water, &c. in the pipe, and thus counteracts a small part of the external pressure; and therefore the column supported by the remaining pressure must be lighter, that is, shorter. Thus it is found, that rectified spirits will not stand much higher than is competent to a weight of 13 pounds on an inch, the elasticity of its vapour balancing about $\frac{1}{15}$ of the pressure of the air. We shall afterwards have occasion to consider this matter more particularly.

As the medium height of the mercury in the barometer is $29\frac{1}{2}$ inches, we see that the whole globe sustains a pressure equal to the whole weight of a body of mercury of this height; and that all bodies on its surface sustain a part of this in proportion to their surfaces. An ordinary sized man sustains a pressure of several thousand pounds.

38
A difficulty solved.

How comes it then that we are not sensible of a pressure which one should think enough to crush us together? This has been considered as a strong objection to the pressure of the air; for when a man is plunged a few feet under water, he is very sensible of the pressure. The answer is by no means so easy as is commonly imagined. We feel very distinctly the effects of removing this pressure from any part of the body. If any one will apply the open end of a syringe to his hand, and then draw up the piston, he will find his hand sucked into the syringe with great force, and it will give pain; and the soft part of the hand will swell into it, being pressed in by the neighbouring parts, which are subject to the action of the external air. If one lays his hand on the top of a long perpendicular pipe, such as a pump filled to the brim with water, which is at first prevented from running out by the valve below; and if the valve be then opened, so that the water descends, he will then find his hand so hard pressed to the top of the pipe that he cannot draw it away. But why do we only feel the *inequality* of pressure? There is a similar instance wherein we do not feel it, although we cannot doubt of its existence. When a man goes slowly to a great depth under water in a diving-bell, we know unquestionably that he is exposed to a new and very great pressure, yet he does not feel it. But those facts are not sufficiently familiar for general argument. The human body is a bundle of solids, hard or soft, filled or mixed with fluids, and there are few or no parts of it which are empty. All communicate either by vessels or pores; and the whole surface is a sieve through which the insensible perspiration is performed. The whole extended surface of the lungs is open to the pressure of the atmosphere; every thing is therefore in equilibrio: and if free or speedy access be given to every part, the body will not be damaged by the pressure, however great, any more than a wet sponge would be deranged by plunging it any depth in water. The pressure is instantaneously diffused by means of the incompressible fluids with which the parts are filled; and if any parts are filled with air or other compressible fluids, these are compressed till their elasticity again balances the pressure. Besides, all our fluids are acquired slowly, and gradually mixed with that proportion of air which they can dissolve or contain. The whole animal has grown up in this manner from the first vital atom of the embryo. For such reasons the pressure can occasion no change of shape by squeezing together the flexible parts; nor any obstruction by compressing the vessels or pores. We cannot say what would be felt by a man, were it possible that he could have been produced and grown up *in vacuo*, and then subjected to the compression. We even know that any sudden and considerable change of general pressure is very severely felt. Persons in a diving-bell have been almost killed by letting them down or drawing them up too suddenly. In drawing up, the elastic matters within have suddenly swelled, and not finding an immediate escape have burst the vessels. Dr Halley experienced this, the blood gushing out from his ears by the expansion of air contained in the internal cavities of this organ, from which there are but very slender passages.

39 The weather-glass.

A very important observation recurs here: the pressure of the atmosphere is variable. This was observed almost as soon as philosophers began to attend to the barometer. Paschal observed it in France, and Descartes observed it in Sweden in 1650. Mr Boyle and others observed it in England in 1656. And before this, observers, who took notice of the concomitancy of these changes of aerial pressure with the state of the atmosphere, remarked, that it was generally greatest in winter and in the night; and certainly most variable during winter and in the northern regions. Familiar now with the weight of the air, and considering it as the vehicle of the clouds and vapours, they noted with care the connection between the weather and the pressure of the air, and found that a great pressure of the air was generally accompanied with fair weather, and a diminution of it with rain and mists. Hence the barometer came to be considered as an index not only of the present state of the air's weight, but also as indicating by its variations changes of weather. It became a WEATHER-GLASS, and continued to be anxiously observed with this view. This is an important subject, and in another place is treated in some detail.

40 The pressure of the air in proportion to the elevation

In the next place, we may conclude that the pressure of the air will be different in different places, according to their elevation above the surface of the ocean: for if air be an heavy fluid, it must press in some proportion according in its perpendicular height. If it be a homogeneous fluid of equal density and weight in all its parts, the mercury in the cistern of a barometer must be pressed precisely in proportion to the depth to which that cistern is immersed in it; and as this pressure is exactly measured by the height of the mercury in the tube, the height of the mercury in the Toricellian tube must be exactly proportional to the depth of the place of observation under the surface of the atmosphere.

41 first supposed by Descartes and Paschal, and proved by experiments,

The celebrated Descartes first entertained this thought (Epist. 67. of Pr. III.) and soon after him Paschal. His occupation in Paris not permitting him to try the justness of his conjecture, he requested Mr Perrier a gentleman of Clermont in Auvergne, to make the experiment, by observing the height of the mercury at one and the same time at Clermont and on the top of a very high mountain in the neighbourhood. His letters to Mr Perrier in 1647 are still extant. Accordingly Mr Perrier, in September 1648, filled two equal tubes with mercury, and observed the heights of both to be the same, viz. 26$\frac{7}{24}$ inches, in the garden of the convent of the Friars Minims, situated in the lowest part of Clermont. Leaving one of them there, and one of the fathers to observe it, he took the other to the top of Puy de Domme, which was elevated nearly 500 French fathoms above the garden. He found its height to be 23$\frac{2}{24}$ inches. On his return to the town, in a place called *Font de l'Arbre*, 150 fathoms above the garden, he found it 25 inches; when he returned to the garden it was again 26$\frac{7}{24}$, and the person set to watch the tube which had been left said that it had not varied the whole day. Thus a difference of elevation of 3000 French feet had occasioned a depression of 3$\frac{1}{8}$ inches; from which it may be concluded, that 3$\frac{1}{8}$ inches of mercury weighs as much as 3000 feet of air, and one-tenth of an inch of mercury as much as 96 feet of air. The next day he found, that taking the tube to the top of a steeple 120 feet high made a fall of one-sixth of an inch. This gives 72 feet of air for one tenth of an inch of mercury; but ill agreeing with the former experiment. But it is to be observed, that a very small error of observation of the barometer would correspond to a great difference of elevation, and also that the height of the mountain had not been measured with any precision. This has been since done (Mem Acad. par. 1703), and found to be 529 French toises.

42 which were repeated by others.

Paschal published an account of this great experiment (*Grande Exp. sur la Pesanteur de l'Air*), and it was quickly repeated in many places of the world. In 1653 it was repeated in England by Dr Power (Power's Exper. Phil.); and in Scotland, in 1661, by Mr Sinclair professor of philosophy in the university of Glasgow, who observed the barometer at Lanark, on the top of Mount Tinto in Clydesdale, and on the top of Arthur's Seat at Edinburgh. He found a depression of two inches between Glasgow and the top of Tinto, three quarters of an inch between the bottom and top of Arthur's Seat, and $\frac{5}{12}$ of an inch at the cathedral of Glasgow on a height of 126 feet. See Sinclair's *Ars Nova et Magna Gravitatis et Levitatis*; *Sturmii Collegium Experimentale*, and *Schotti Technica Curiosa*.

43 Hence a method of measuring heights.

Hence we may derive a method of measuring the heights of mountains. Having ascertained with great precision the elevation corresponding to a fall of one-tenth of an inch of mercury, which is nearly 90 feet, we have only to observe the length of the mercurial column at the top and bottom of the mountain, and to allow 90 feet for every tenth of an inch. Accordingly this method has been practised with great success: but it requires an attention to many things not yet considered; such as the change of density of the mercury by heat and cold; the changes of density of air, which are much more remarkable from the same causes; and above all, the changes of the density of air from its compressibility; a change immediately connected with or dependent on the very elevation we wish to measure. Of all these afterwards.

44 Also a measure of the density of the air.

These observations give us the most accurate measure of the density of air and its specific gravity. This is but vaguely though directly measured by weighing air in a bladder or vessel. The weight of a manageable quantity is so small, that a balance sufficiently ticklish to indicate even very sensible fractions of it is overloaded by the weight of the vessel which contains it, and ceases to be exact: and when we take Bernouilli's ingenious method of suspending it in water, we expose ourselves to great risk of error by the variation of the water's density. Also it must necessarily be humid air which we can examine in this way: but the proportion of an elevation in the atmosphere to the depression of the column of mercury or other fluid, by which we measure its pressure, gives us at once the proportion of this weight or their specific gravity. Thus since it is found that in such a state of pressure the barometer stands at 30 inches, and the thermometer at 32°, 87 feet of rise produces one-tenth of an inch of fall in the barometer, the air and the mercury being both of the freezing temperature, we must conclude that mercury is 10,440 times heavier or denser than air. Then, by comparing mercury and water, we get $\frac{1}{801}$ nearly for the density of air relative to water: but this varies so much by heat and moisture, that it is useless to retain any thing more than a general notion of it; nor is it easy to determine whether this method or that by actual weighing be preferable. It is extremely difficult to observe the height of the mercury in the barometer nearer than $\frac{1}{100}$ of an inch; and this will produce a difference of even five feet, or $\frac{1}{18}$ of the whole. Perhaps this is a greater proportion than the error in weighing.

45 nd some nowledge f the eight of he atmophere.

From the same experiments we also derive some knowledge of the height of the aerial covering which surrounds our globe. When we raise our barometer 87 feet above the surface of the sea, the mercury falls about one-tenth of an inch in the barometer: therefore if the barometer shows 30 inches at the sea-shore, we may expect that, by raising it 300 times 87 feet, or 5 miles, the mercury in the tube will descend to the level of the cistern, and that this is the height of our atmosphere. But other appearances lead us to suppose a much greater height. Meteors are seen with us much higher than this, and which yet give undoubted indication of being supported by our air. There can be little doubt, too, that the visibility of the expanse above us is owing to the reflection of the sun's light by our air. Were the heavenly spaces perfectly transparent, we should no more see them than the purest water through which we see other objects; and we see *them* as we see water tinged with milk or other fæculæ. Now it is easy to show, that the light which gives us what is called twilight must be reflected from the height of at least 50 miles; for we have it when the sun is depressed 18 degrees below our horizon.

46 Vhy this nowledge not acurate.

A little attention to the constitution of our air will convince us, that the atmosphere must extend to a much greater height than 300 times 87 feet. We see from the most familiar facts that it is compressible; we can squeeze it in an ox-bladder. It is also heavy; pressing on the air in this bladder with a very great force, not less than 1500 pounds. We must therefore consider it as in a state of compression, existing in smaller room than it would assume if it were not compressed by the incumbent air. It must therefore be in a condition something resembling that of a quantity of fine carded wool thrown loosely into a deep pit; the lower strata carrying the weight of the upper strata, and being compressed by them; and so much the more compressed as they are further down, and only the upper stratum in its unconstrained and most expanded state. If we shall suppose this wool thrown in by a hundred weight at a time, it will be divided into strata of equal weights, but of unequal thickness: the lowest being the thinnest, and the superior strata gradually increasing in thickness. Now, suppose the pit filled with air, and reaching to the top of the atmosphere, the *weights* of all the strata above any horizontal plane in it is measured by the height of the mercury in the Toricellian tube placed in that plane; and one-tenth of an inch of mercury is just equal to the weight of the lowest stratum 87 feet thick: for on raising the tube 87 feet from the sea, the surface of the mercury will descend one-tenth of an inch. Raise the tube till the mercury fall another tenth: This stratum must be more than 87 feet thick; how much more we cannot tell, being ignorant of the law of the air's expansion. In order to make it fall a third tenth, we must raise it through a stratum still thicker; and so on continually.

All this is abundantly confirmed by the very first experiment made by the order and directions of Paschal: For by carrying the tube from the garden of the convent to a place 150 fathoms higher, the mercury fell $1\frac{7}{24}$ inches, or 1.2916; which gives about 69 feet 8 inches of aerial stratum for $\frac{1}{10}$ of an inch of mercury; and by carrying it from thence to a place 350 fathoms higher, the mercury fell $1\frac{22}{24}$, or 1.9167 inches, which gives 109 feet 7 inches for $\frac{1}{10}$ of an inch of mercury. These experiments were not accurately made; for at that time the philosophers, though zealous, were but *scholars* in the *science* of experimenting, and novices in the art. But the results abundantly show this general truth, and they are completely confirmed by thousands of subsequent observations. It is evident from the whole tenor of them, that the strata of air decrease in density as we ascend through the atmosphere; but it remained to be discovered what is the force of this decrease, that is, the law of the air's expansion. Till this be done we can say nothing about the constitution of our atmosphere: we cannot tell in what manner it is fittest for raising and supporting the exhalations and vapours which are continually arising from the inhabited regions; not as an excrementitious waste, but to be supported, perhaps manufactured, in that vast laboratory of nature, and to be returned to us in beneficent showers. We cannot use our knowledge for the curious, and frequently useful, purpose of measuring the heights of mountains and taking the levels of extensive regions; in short, without an accurate knowledge of this, we can hardly acquire any acquaintance with those mechanical properties which distinguish air from those liquids which circulate here below.

47 Compressibility of the air.

Having therefore considered at some length the leading consequences of the air's fluidity and gravity, let us consider its compressibility with the same care; and then, combining the agency of both, we shall answer all the purposes of philosophy, discover the laws, explain the phenomena of nature, and improve art. We proceed therefore to consider a little the phenomena which indicate and characterise this other property of the air. All fluids are elastic and compressible as well as air; but in them the compressibility makes no figure, or does not interest us while we are considering their pressures, motions, and impulsions. But in air the compressibility and expansion draw our chief attention, and make it a proper representative of this class of fluids.

48 A familiar phenomenon, which

Nothing is more familiar than the compressibility of air. It is seen in a bladder filled with it, which we can forcibly squeeze into less room; it is seen in a syringe, of which we can push the plug farther and farther as we increase the pressure.

49 shews its elasticity.

But these appearances bring into view another, and the most interesting, property of air, viz. its *elasticity*. When we have squeezed the air in the bladder or syringe into less room, we find that the force with which we *compressed* it is necessary to *keep it in this bulk;* and that if we cease to press it together, it will swell out and regain its natural dimensions. This distinguishes it essentially from such a body as a mass of flour, salt, or such like, which remain in the compressed state to which we reduce them.

50 resisting force, and producing motion.

There is something therefore which opposes the compression different from the simple impenetrability of the air: there is something that opposes mechanical force: there is something too which produces motion, not only resisting compression, but pushing back the compressing body, and communicating motion to it. As an arrow is gradually accelerated by the bow string pressing it forward, and at the moment of its discharge is brought to a state of rapid motion; so the ball from a pop-gun or wind-gun is gradually accelerated along the barrel by the pressure of the air during its expansion from its compressed state, and finally quits it with an accumulated velocity. These two motions are indications perfectly similar of the elasticity of the bow and of the air.

51 Fluidity of the air

Thus it appears that air is heavy and elastic. It needs little consideration to convince us in a vague manner that it is fluid. The ease with which it is penetrated, and driven about in every direction, and the motion of it in pipes and channels, however crooked and intricate, entitle it to this character. But before we can proceed to deduce consequences from its fluidity, and to offer them as a true account of what will happen in these circumstances, it is necessary to exhibit some distinct and simple case, in which the characteristic mechanical property of a fluid is clearly and unequivocally observed in it. That property of fluids from which all the laws of hydrostatics and hydraulics are derived with strictest evidence is, that any pressure applied to any part of them is propagated through the whole mass in every direction; and that in consequence of this diffusion of pressure, any two external forces can be put in equilibrio by the interposition of a fluid, in the same way as they can be put in equilibrio by the intervention of any mechanical engine.

52 experimentally Fig. 7.

Let a close vessel ABC (fig. 7.), of any form, have two upright pipes EDC, GFB, inserted into any parts of its top, sides, or bottom, and let water be poured into them, so as to stand in equilibrio with the horizontal surface at E, D, G, F, and let D *d*, F *f*, be horizontal lines, *it will be found* that the height of the column E *d* is sensibly equal to that of the column G *f*. This is a fact universally observed in whatever way the pipes are inserted.

53 proved.

Now the surface of the water at D is undoubtedly pressed upwards with a force equal to a column of water, having its surface for its base, and E *d* for its height; it is therefore prevented from rising by some opposite force. This can be nothing but the elasticity of the confined air pressing it down. The very same thing must be said of the surface at F; and thus there are two external pressures at D and F set in equilibrio by the interposition of air. The force exerted on the surface D, by the pressure of the column E *d*, is therefore propagated to the surface at F: and thus air has this characteristic mark of fluidity.

In this experiment the *weight* of the air is insensible when the vessel is of small size, and has no sensible share in the pressure reaching at D and F. But if the elevation of the point F above D is very great, the column E *d will be observed* sensibly to exceed the column G *f*. Thus if F be 70 feet higher than D, E *d* will be an inch longer than the column G *f*: for in this case there is reacting at D, not only the pressure propagated from F, but also the weight of a column of air, having the surface at D for its base and 70 feet high. This is equal to the weight of a column of water one inch high.

It is by this propagation of pressure, this *fluidity*, that the pellet is discharged from a child's pop gun. It sticks fast in the muzzle; and he forces in another pellet at the other end, which he presses forward with the rammer, condensing the air between them, and thus propagating to the other pellet the pressure which he exerts, till the friction is overcome, and the pellet is discharged by the air expanding and following it.

54 Hero's fountain. Fig. 8.

There is a pretty philosophical plaything which illustrates this property of air in a very perspicuous manner, and which we shall afterwards have occasion to consider as converted into a most useful hydraulic machine. This is what is usually called *Hero's fountain*, having been invented by a Syracusan of that name. It consists of two vessels KLMN (fig. 8.), OPQR, which are close on all sides. The tube AB, having a funnel a-top, passes through the uppermost vessel without communicating with it, being soldered into its top and bottom. It also passes through the top of the under vessel, where it is also soldered, and reaches almost to its bottom. This tube is open at both ends. There is another open tube ST, which is soldered into the top of the under vessel and the bottom of the upper vessel, and reaches almost to its top. These two tubes serve also to support the upper vessel. A third tube GF is soldered into the top of the upper vessel, and reaches almost to its bottom. This tube is open at both ends, but the orifice G is very small. Now suppose the uppermost vessel filled with water to the height EN, E *e* being its surface a little below T. Stop the orifice G with the finger, and pour in water at A. This will descend through AB, and compress the air in OPQR into less room. Suppose the water in the under vessel to have acquired the surface C *c*, the air which formerly occupied the whole of the spaces OPQR, and KL *e* E, will now be contained in the spaces *o* P *r* C and KL *e* E; and its elasticity will be in equilibrio with the weight of the column of water, whose base is the surface E *e*, and whose height is A *c*. As this pressure is exerted in every part of the air, it will be exerted on the surface E *e* of the water of the upper vessel, and if the pipe FG were continued upwards, the water would be supported in it to an height *e* H above E *e*, equal to A *c*. Therefore if the finger be now taken from off the orifice G, the water will spout up to the same height as if it had been immediately forced out by a column of water A *c* without the intervention of the air, that is, nearly to H. If instead of the funnel at A, the vessel have a brim VW which will cause the water discharged at G to run down the pipe AB, this fountain will play till all the water in the upper vessel is expended. The operation of this second fountain will be better understood from fig. 9. which an intelligent reader will see is perfectly equivalent to fig. 8. Fig. 9. A very powerful engine for raising water upon this principle has long been employed in the Hungarian mines; where the pipe AB is about 200 feet high, and the pipe FG about 120; and the condensation is made in the upper vessel, and communicated to the lower, at the bottom of the mine, by a long pipe. See *Water-Works*.

55 Laws of hydrostatics applicable to air.

We may now apply to air all the laws of hydrostatics and hydraulics, in perfect confidence that their legitimate consequences will be observed in all its situations. We shall in future substitute, in place of any force acting on a surface of air, a column of water, mercury, or any other fluid whose weight is equal to this force: and as we know distinctly from theory what will be the consequences of this hydrostatic pressure, we shall determine *à priori* the phenomena in air; and in cases where theory does not enable us to say with precision what is the effect of this pressure, experience informs us in the case of water, and analogy enables us to transfer this to air. We shall find this of great service in some cases, which otherwise are almost desperate in the present state of our knowledge.

56 More refined experiments, such as

From such familiar and simple observations and experiments, the fluidity, the heaviness, and elasticity, are discovered of the substance with which we are surrounded, and which we call *air*. But to understand these properties, and completely to explain their numerous and important consequences, we must call in the aid of more refined observations and experiments, which even this scanty knowledge of them enables us to make; we must contrive some methods of producing with precision any degree of condensation or rarefaction, of employing or excluding the gravitating pressure of air, and of modifying at pleasure the action of all its mechanical properties.

57 a method of compressing the air by Plate cccxxiv. fig. 10.

Nothing can be more obvious than a method of compressing a quantity of air to any degree. Take a cylinder or prismatic tube AB (fig. 10.) shut at one end, and fit it with a piston or plug C, so nicely that no air can pass by its sides. This will be best done in a cylindric tube by a turned stopper, covered with oiled leather, and fitted with a long handle CD. When this is thrust down, the air which formerly occupied the whole capacity of the tube is *condensed* into less room. The force necessary to produce any degree of compression may be concluded from the weight necessary for pushing down the plug to any depth. But this instrument leaves us little opportunity of making interesting experiments on or in this condensed air; and the force required to make any degree of compression cannot be measured with much accuracy; because the piston must be very close, and have great friction in order to be sufficiently tight: And as the compression is increased, the leather is more squeezed to the side of the tube; and the proportion of the external force, which is employed merely to overcome this variable and uncertain friction, cannot be ascertained with any tolerable precision. To get rid of these imperfections, the following addition may be made to the instrument, which then becomes what is called the *condensing syringe*.

58 the condensing syringe with

The end of the syringe is perforated with a very small hole *e f*; and being externally turned to a small cylinder, a narrow slip of bladder, or of thin leather; soaked in a mixture of oil and tallow, must be tied over the hole. Now let us suppose the piston pushed down to the bottom of the barrel to which it applies close; when it is drawn up to the top, it leaves a void behind, and the weight of the external air presses on the slip of bladder, which therefore claps close to the brass, and thus performs the part of a valve, and keeps it close so that no air can enter. But the piston having reached the top of the barrel, a hole F in the side of it is just below the piston, and the air rushes through this hole and fills the barrel. Now push the piston down again, it immediately passes the hole F, and no air escapes through it; it therefore forces open the valve at *f*, and escapes while the piston moves to the bottom.

59 its vessel or receiver.

Now let E be any vessel, such as a glass bottle, having its mouth furnished with a brass cap firmly cemented to it, having a hollow screw which fits a solid screw *p o*, turned on the cylindric nozzle of the syringe. Screw the syringe into this cap, and it is evident that the air forced out of the syringe will be accumulated in this vessel: for upon drawing up the piston the valve *f* always shuts by the elasticity or expanding force of the air in E; and on pushing it down again, the valve will open as soon as the piston has got so far down that the air in the lower part of the barrel is more powerful than the air already in the vessel. Thus at every stroke an additional barrelful of air will be forced into the vessel E; and it will be found, that after every stroke the piston must be farther pushed down before the valve will open. It cannot open till the pressure arising from the elasticity of the air condensed in the barrel is superior to the elasticity of the air condensed in the vessel; that is, till the condensation of the first, or its density, is *somewhat* greater than that of the last, in order to overcome the straining of the valve on the hole and the sticking occasioned by the clammy matter employed to make it air-tight.

60 A different construction of the syringe.

Sometimes the syringe is constructed with a valve in the piston. This piston, instead of being of one piece and solid, consists of two pieces perforated. The upper part *i k n m* is connected with the rod or handle, and has its lower part turned down to a small cylinder, which is screwed into the lower part *k l o n*; and has a perforation *g h* going up in the axis, and terminating in a hole *h* in one side of the rod, a piece of oiled leather is strained across the hole *g*. When the piston is drawn up and a void left below it, the weight of the external air forces it through the hole *h g*, opens the valve *g*, and fills the barrel. Then, on pushing down the piston, the air being squeezed into less room, presses on the valve *g*, shuts it; and none escaping through the piston, it is gradually condensed as the piston descends till it opens the valve *f*, and is added to that already accumulated in the vessel E.

61 Elasticity of the air increased by condensation.

Having in this manner forced a quantity of air into the vessel E, we can make many experiments in it in this state of condensation. We are chiefly concerned at present with the effect which this produces on its elasticity. We see this to be greatly increased: for we find more and more force required for introducing every successive barrelful. When the syringe is unscrewed, we see the air rush out with great violence, and every indication of great expanding force. If the syringe be connected with the vessel E in the same manner as the syringe in N° 17. viz. by interposing a stopcock B between them (see fig. 3.), and if this stopcock have a pipe at its extremity, reaching near to the bottom of the vessel, which is previously half filled with water, we can observe distinctly when the elasticity of the air in the syringe exceeds that of the air in the receiver: for the piston must be pushed down a certain length before the air from the syringe bubbles up through the water, and the piston must be farther down at each successive stroke before this appearance is observed. When the air has thus been accumulated in the receiver, it presses the sides of it outward, and will burst it if not strong enough. It also presses on the surface of the water; and if we now shut the cock, unscrew the syringe, and open the cock again, the air will force the water through the pipe with great velocity, causing it to rise in a beautiful jet. When a metal-receiver is used, the condensation may be pushed to a great length, and the jet will then rise to a great height, which gradually diminishes as the water is expended and room given to the air to expand itself. See the figure.

62 A method of judging of the condensation, &c. We judge of the condensation of air in the vessel E by the number of strokes and the proportion of the capacity of the syringe to that of the vessel. Suppose the first to be one-tenth of the last; then we know, that after 10 strokes the quantity of air in the vessel is doubled, and therefore its density double, and so on after any number of strokes. Let the capacity of the syringe (when the piston is drawn to the top) be a, and that of the vessel be b, and the number of strokes be n, the density of air in the vessel will be $\frac{b \times n a}{b}$, or $1+\frac{n a}{b}$.

63 not perfectly accurate. But this is on the supposition that the piston accurately fills the barrel, the bottom of the one applying close to that of the other, and that no force is necessary for opening either of the valves: but the first cannot be insured, and the last is very far from being true. In the construction now described, it will require at least one-twentieth part of the ordinary pressure of the air to open the piston valve: therefore the air which gets in will want at least this proportion of its complete elasticity; and there is always a similar part of the elasticity employed in opening the nozzle valve. The condensation therefore is never nearly equal to what is here determined.

64 A better method. It is accurately enough measured by a gage fitted to the instrument. A glass tube GH of a cylindric bore, and close at the end, is screwed into the side of the cap on the mouth of the vessel E. A small drop of water or mercury is taken into this tube by warming it a little in the hand, which expands the contained air, so that when the open end is dipped into water, and the whole allowed to cool, the water advances a little into the tube. The tube is furnished with a scale divided into small equal parts, numbered from the close end of the tube. Since this tube communicates with the vessel, it is evident that the condensation will force the water along the tube, acting like a piston on the air beyond it, and the air in the tube and vessel will always be of one density. Suppose the number at which the drop stands before the condensation is made to be c, and that it stands at d when the condensation has attained the degree required, the density of the air in the remote end of the gage, and consequently in the vessel, will be $\frac{c}{d}$.

65 A variation of it. Sometimes there is used any bit of tube close at one end, having a drop of water in it, simply laid into the vessel E, and furnished or not with a scale: but this can only be used with glass vessels, and these are too weak to resist the pressure arising from great condensation. In such experiments metalline vessels are used, fitted with a variety of apparatus for different experiments. Some of these will be occasionally mentioned afterwards.

66 Syringes for great condensations. It must be observed in this place, that very great condensations require great force, and therefore small syringes. It is therefore convenient to have them of various sizes, and to begin with those of a larger diameter, which operate more quickly; and when the condensation becomes fatiguing, to change the syringe for a smaller.

67 A stop-cock between the syringe and receiver. For this reason, and in general to make the condensing apparatus more convenient, it is proper to have a stop-cock interposed between the syringe and the vessel, or as it is usually called the receiver. This consists of a brass pipe, which has a well ground cock in its middle, and has a hollow screw at one end, which receives the nozzle screw of the syringe, and a solid screw at the other end, which fits the screw of the receiver. See fig. 3.

68 Instances of great condensation prov By these gages, or contrivances similar to them, we have been able to ascertain very great degrees of condensation in the course of some experiments. Dr Hales found, that when dry wood was put into a strong vessel, which it almost filled, and the remainder was filled with water, the swelling of the wood, occasioned by its imbibition of water, condensed the air of his gage into the thousandth of its original bulk. He found that pease treated in the same way generated elastic air, which pressing on the air in the gage condensed it into the fifteen hundredth part of its bulk. This is the greatest condensation that has been ascertained with precision, although in other experiments it has certainly been carried much farther; but the precise degree could not be ascertained.

69 air and water to be essentially different. The only use to be made of this observation at present is, that since we have been able to exhibit air in a density a thousand times greater than the ordinary density of the air we breathe, it cannot, as some imagine, be only a different form of water; for in this state it is as dense or denser than water, and yet retains its great expansibility.

70 and shew the error of some opinions respecting elasticity, &c. Another important observation is, that in every state of density in which we find it, it retains its perfect fluidity, transmitting all pressures which are applied to it with undiminished force, as appears by the equality constantly observed between the opposing columns of water or other fluid by which it is compressed, and by the facility with which all motions are performed in it in the most compressed states in which we can make observations of this kind. This fact is totally incompatible with the opinion of those who ascribe the elasticity of air to the springy ramified structure of its particles, touching each other like so many pieces of sponge or foot-balls. A collection of such particles might indeed be pervaded by solid bodies with considerable ease, if they were merely touching each other, and not subjected to any external pressure. But the moment such pressure is exerted, and the assemblage squeezed into a smaller space, each presses on its adjoining particles: they are individually compressed, flattened in their touching surfaces, and *before the density is doubled* they are squeezed into the form of perfect cubes, and compose a

mass, which may indeed propagate pressure from one place to another in an imperfect manner, and with great diminution of its intensity, but will no more be fluid than a mass of soft clay. It will be of use to keep this observation in mind.

71 onsequences of the ir's elascity.

We have seen the air is heavy and compressible, and might now proceed to deduce in order the explanation of the appearances consequent on each of these properties. But, as has been already observed, the elasticity of air modifies the effects of its gravity so remarkably, that they would be imperfectly understood if both qualities were not combined in our consideration of either. At any rate, some farther consequences of its elasticity must be considered, before we understand the means of varying at pleasure the effects of its gravity.

72 s great xpansibity

Since air is heavy, the lower strata of a mass of air must support the upper; and, being compressible, they must be condensed by their weight. In this state of compression the elasticity of the lower strata of air acts in opposition to the weight of the incumbent air, and balances it. There is no reason which would make us suppose that its expanding force belongs to it only when in such a state of compression. It is more probable, that, if we could free it from this pressure, the air would expand itself into still greater bulk. This is most distinctly seen in the following experiment.

73 roved by xperiment. Fig. 11.

Into the cylindric jar ABCD (fig. 11.) which has a small hole in its bottom, and is furnished with an air-tight piston E, put a small flaccid bladder, having its mouth tied tight with a string. Having pushed the piston near to the bottom, and noticed the state of the bladder, stop up the hole in the bottom of the jar with the finger, and draw up the piston, which will require a considerable force. You will observe the bladder swell out, as if air had been blown into it; and it will again collapse on allowing the piston to descend. Nothing can be more unexceptionable than the conclusion from this experiment, that ordinary air is in a state of compression, and that its elasticity is not limited to this state. The bladder being flaccid, shows that the included air is in the same state with the air which surrounds it; and the same must be affirmed of it while it swells but still remains flaccid. We must conclude, that the whole air within the vessel expands, and continues to fill it, when its capacity has been enlarged. And since this is observed to go on as long as we give it more room, we conclude, that by such experiments we have not yet given it so much room as it can occupy.

74 ttempts discover e limits this exansion by

It was a natural object of curiosity to discover the limits of this expansion; to know what was the natural unconstrained bulk of a quantity of air, beyond which it would not expand though all external compressing force were removed. Accordingly philosophers constructed instruments for *rarefying* the air. The common water pump had been long familiar, and appeared very proper for this purpose. The most obvious is the following.

75 syringe; Fig. 12.

Let the barrel of the syringe AB (fig. 12.) communicate with the vessel V, with a stopcock C between them. Let it communicate with the external air by another orifice D, in any convenient situation, also furnished with a stopcock. Let this syringe have a piston very accurately fitted to it so as to touch the bottom all over when pushed down, and have no vacancy about the sides.

76 from the operation of which

Now, suppose the piston at the bottom, the cock C open, and the cock D shut, draw the piston to the top. The air which filled the vessel V will expand so as to fill both that vessel and the barrel AB; and as no reason can be given to the contrary, we must suppose that the air will be uniformly diffused through both. Calling V and B the capacity of the vessel and barrel, it is plain that the bulk of the air will now be $V+B$; and since the quantity of matter remains the same, and the density of a fluid is as its quantity of matter directly and its bulk inversely, the density of the expanded air will be $\frac{V}{V+B}$, the density of common air being 1: for $V+B : V = 1 : \frac{V}{V+B}$.

77 we infer the diminution of the elasticity of expanded air.

The piston requires force to raise it, and it is raised in opposition to the pressure of the incumbent atmosphere; for this had formerly been balanced by the elasticity of the common air: and we conclude from the fact, *that force is required to raise the piston*, that the elasticity of the expanded air is less than that of air in its ordinary state; and an accurate observation of the force necessary to raise it would show how much the elasticity is diminished. When therefore the piston is let go, it will descend as long as the pressure of the atmosphere exceeds the elasticity of the air in the barrel; that is, till the air in the barrel is in a state of ordinary density. To put it further down will require force, because the air must be compressed in the barrel; but if we open the cock D, the air will be expelled through it, and the piston will reach the bottom.

78 and calculate its density.

Now shut the *discharging cock* D, and open the cock C, and draw up the piston. The air which occupied the space V, with the density $\frac{V}{V+B}$, will now occupy the space $V+B$, if it expands so far. To have its density D, say, As its present bulk $V+B$ is to its former bulk V, so is its former density $\frac{V}{V+B}$ to its new density, which will therefore be $\frac{V+V}{\overline{V+B}\times\overline{V+B}}$, or $\left.\overline{\frac{V}{V+B}}\right|^{2}$.

79 It is evident, that if the air continues to expand, the density of the air in the vessel after the third drawing up of the piston will be $\left.\overline{\frac{V}{V+B}}\right|^{3}$, after the fourth it will be $\left.\overline{\frac{V}{V+B}}\right|^{4}$, and after any number of strokes *n* will be $\left.\overline{\frac{V}{V+B}}\right|^{n}$. Thus, if the vessel is four times as large as the barrel, the density after the fifth stroke will be $\frac{1024}{3125}$, nearly $\frac{1}{3}$ of its ordinary density.

80 On the other hand, the number *n* of strokes necessary for reducing air to the density D is $\frac{\text{Log } D}{\text{Log } V - \text{Log } (V+B)}$.

81 Some inconveniences of this instrument.

Thus we see that this instrument can never abstract the whole air in consequence of its expansion, but only rarefy it continually as long as it continues to expand; nay, there is a limit beyond which the rarefaction cannot

not go. When the piston has reached the bottom, there remains a small space between it and the cock C filled with common air. When the piston is drawn up, this small quantity of air expands, and also a similar quantity in the neck of the other cock; and no air will come out of the receiver V till the expanded air in the barrel is of a smaller density than the air in the receiver. This circumstance evidently directs us to make these two spaces as small as possible, or by some contrivance to fill them up together. Perhaps this may be done effectually in the following manner.

82 Remedied by another. Fig. 13.

Let BE (fig. 13.) represent the bottom of the barrel, and let the circle HKI be the section of the key of the cock, of a large diameter, and place it as near to the barrel as can be. Let this communicate with the barrel by means of a hole FG widening upwards, as the frustum of a hollow obtuse cone. Let the bottom of the piston *bfhge* be shaped so as to fit the bottom of the barrel and this hole exactly. Let the cock be pierced with two holes. One of them, HI, passes perpendicularly through its axis, and forms the communication between the receiver and barrel. The other hole, KL, has one extremity K on the same circumference with H, so that when the key is turned a fourth part round, K will come into the place of H: but this hole is pierced obliquely into the key, and thus keeps clear of the hole HI. It goes no further than the axis, where it communicates with a hole bored along the axis, and terminating at its extremity. This hole forms the communication with the external air, and serves for discharging the air in the barrel. (A side view of the key is seen in fig. 14.). Fig. 12. shows the position of the cock while the piston is moving upwards, and fig. 14. shows its position while the piston is moving downwards. When the piston has reached the bottom, the conical piece *fhg* of the piston, which may be of firm leather, fills the hole FHG; and therefore completely expels the air from the barrel. The canal KL*l* of the cock contains air of the common density; but this is turned aside into the position KL (fig. 13.), while the piston is still touching the cock. It cannot extend into the barrel during the ascent of the piston. In place of it the perforation HLI comes under the piston, filled with air that had been turned aside with it when the piston was at the top of the barrel, and therefore of the same density with the air of the receiver. It appears therefore that there is no limit to the rarefaction as long as the air will expand.

Fig. 14.

83 called an *exhausting syringe*.

This instrument is called an Exhausting Syringe. It is more generally made in another form, which is much less expensive, and more convenient in its use. Instead of being furnished with cocks for establishing the communications and shutting them, as is necessary, it has *valves* like those of the condensing syringe, but opening in the opposite direction. It is thus made:

84 Its construction and Fig. 15.

The pipe of communication or conduit MN (fig. 15.) has a male screw in its extremity, and over this is tied a slip of bladder or leather M. The lower half of the piston has also a male screw on it, covered at the end with a slip of bladder O. This is screwed into the upper half of the piston, which is pierced with a hole H coming out of the side of the rod.

85 operation.

Now suppose the syringe screwed to the conducting pipe, and that screwed into the receiver V, and the piston at the bottom of the barrel. When the piston is drawn up, the pressure of the external air shuts the valve O, and a void is left below the piston: there is therefore no pressure on the upper side of the valve M to balance the elasticity of the air in the receiver which formerly balanced the weight of the atmosphere. The air therefore in the receiver lifts this valve, and distributes itself between the vessel and the barrel; so that when the piston has reached the top the density of the air in both receiver and barrel is as before $\frac{V}{V+B}$.

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When the piston is let go it descends, because the elasticity of the expanded air is not a balance for the pressure of the atmosphere, which therefore presses down the piston with the difference, keeping the piston-valve shut all the while. At the same time the valve M also shuts: for it was opened by the prevailing elasticity of the air in the receiver, and while it is open the two airs have equal density and elasticity; but the moment the piston descends, the capacity of the barrel is diminished, the elasticity of its air increases by collapsing, and now prevailing over that of the air in the receiver shuts the valve M.

87

When it has arrived at such a part of the barrel that the air in it is of the density of the external air, there is no force to push it farther down; the hand must therefore press it. This attempts to condense the air in the barrel, and therefore increases its elasticity; so that it lifts the valve O and escapes, and the piston gets to the bottom. When drawn up again, greater force is required than the last time, because the elasticity of the included air is less than in the former stroke. The piston rises further before the valve M is lifted up, and when it has reached the top of the barrel the density of the included air is $\left.\overline{\frac{V}{V+B}}\right|^{4}$. The piston, when let go, will descend further than it did before ere the piston-valve open, and the pressure of the hand will again push it to the bottom, all the air escaping through O. The rarefaction will go on at every successive stroke in the same manner as with the other syringe.

88 Advantages of this syringe over the former, and

This syringe is evidently more easy in its use, requiring no attendance to the cocks to open and shut them at the proper times. On this account this construction of an exhausting syringe is much more generally used.

89 its inferiority.

But it is greatly inferior to the syringe with cocks with respect to its power of rarefaction. Its operation is greatly limited. It is evident that no air will come out of the receiver unless its elasticity *exceed* that of the air in the barrel by a difference able to lift up the valve M. A piece of oiled leather tied across this hole can hardly be made tight and certain of clapping to the hole without some small straining, which must therefore be overcome. It must be very gentle indeed not to require a force equal to the weight of two inches of water, and this is equal to about the 200th part of the whole elasticity of the ordinary air; and therefore this syringe, for this reason alone, cannot rarefy air above 200 times, even though air were capable of an indefinite expansion. In like manner the valve O cannot be raised without a similar prevalence of the elasticity of the air in the barrel above the weight of the atmosphere. These causes united make it difficult to rarefy the air more than 100 times, and very few such syringes will rarefy it more than 50 times; whereas the syringe with cocks, when new and in good order, will rarefy it 1000 times.

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But, on the other hand, syringes with cocks are much more expensive, especially when furnished with apparatus for opening and shutting the cocks. They are more difficult to make equally tight, and (which is the greatest objection) do not remain long in good order. The cocks, by so frequently opening and shutting, grow loose, and allow the air to escape. No method has been found of preventing this. They must be ground tight by means of emery or other cutting powders. Some of these unavoidably stick in the metal, and continue to wear it down. For this reason philosophers, and the makers of philosophical instruments, have turned their chief attention to the improvement of the syringe with valves. We have been thus minute in the account of the operation of rarefaction, that the reader may better understand the value of these improvements, and in general the operation of the principal pneumatic engines.

Of the Air-Pump.

91
vention
the air-
ump by
uericke.

An Air-Pump is nothing but an exhausting syringe accommodated to a variety of experiments. It was first invented by Otto Guericke, a gentleman of Magdeburgh in Germany, about the year 1654. We trust that it will not be unacceptable to our readers to see this instrument, which now makes a principal article in a philosophical apparatus, in its first form, and to trace it through its successive steps to its present state of improvement.

Guericke, indifferent about the solitary possession of an invention which gave entertainment to numbers who came to see his wonderful experiments, gave a minute description of all his pneumatic apparatus to Gaspar Schottus professor of mathematics at Wirtemberg, who immediately published it with the author's consent, with an account of some of its performances, first in 1657, in his *Mechanica Hydraulico-pneumatica;* and then in his *Technica Curiosa*, in 1664, a curious collection of all the wonderful performances of art which he collected by a correspondence over all Europe.

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mp.
ig. 16.

Otto Guericke's air-pump consists of a glass receiver A (fig. 16.) of a form nearly spherical, fitted up with a brass cap and cock B. The nozzle of the cap was fixed to a syringe CDE, also of brass, bent at D into half a right angle. This had a valve at D, opening from the receiver into the syringe, and shutting when pressed in the opposite direction. In the upper side of the syringe there is another valve F, opening from the syringe into the external air, and shutting when pressed inwards. The piston had no valve. The syringe, the cock B, and the joint of the tube, were immersed in a cistern filled with water. From this description it is easy to understand the operation of the instrument. When the piston was drawn up from the bottom of the syringe, the valve F was kept shut by the pressure of the external air, and the valve D opened by the elasticity of the air in the receiver. When it was pushed down again, the valve D immediately shut by the superior elasticity of the air in the syringe; and when this was sufficiently compressed, it opened the valve F, and was discharged. It was immersed in water, that no air might find its way through the joints or cocks.

93
Its imperfections.

It would seem that this machine was not very perfect, for Guericke says that it took several hours to produce an evacuation of a moderate-sized vessel; but he says, that when it was in good order, the rarefaction (for he acknowledges that it was not, nor could be, a complete evacuation) was so great, that when the cock was opened, and water admitted, it filled the receiver so as sometimes to leave no more than the bulk of a pea filled with air. This is a little surprising: for if the valve F be placed as far from the bottom of the syringe as in Schottus's figure, it would appear that the rarefaction could not be greater than what must arise from the air in DF expanding till it filled the whole syringe: because as soon as the piston in its descent passes F it can discharge no more air, but must compress it between F and the bottom, to be expanded again when the piston is drawn up. It is probable that the piston was not very tight, but that on pressing it down it allowed the air to pass it; and the water in which the whole was immersed prevented the return of the air when it was drawn up again: and this accounts for the great time necessary for producing the desired rarefaction.

94
His improvement of it.

Fig. 17.

Guericke, being a gentleman of fortune, spared no expence, and added a part to the machine, which saved his numerous visitants the trouble of hours attendance before they could see the curious experiments with the rarefied air. He made a large copper vessel G (fig. 17.), having a pipe and cock below, which passed through the floor of the chamber into an under apartment, where it was joined to the syringe immersed in the cistern of water, and worked by a lever. The upper part of the vessel terminated in a pipe, furnished with a stopcock H, surrounded with a small brim to hold water for preventing the ingress of air. On the top was another cap I, also filled with water, to protect the junction of the pipes with the receiver K. This great vessel was always kept exhausted, and workmen attended below. When experiments were to be performed in the receiver K, it was set on the top of the great vessel, and the cock H was opened. The air in K immediately diffused itself equally between the two vessels, and was so much more rarefied as the receiver K was smaller than the vessel G. When this rarefaction was not sufficient, the attendants below immediately worked the pump.

These particulars deserve to be recorded, as they show the inventive genius of this celebrated philosopher, and because they are useful even in the present advanced state of the study. Guericke's method of excluding air from all the joints of his apparatus, by immersing these joints in water, is the only method that has to this day been found effectual; and there frequently occur experiments where this exclusion for a long time is absolutely necessary. In such cases it is necessary to construct little cups or cisterns at every joint, and to fill them with water or oil. In a letter to Schottus, 1662-3, he describes very ingenious contrivances for producing complete rarefaction after the elasticity of the remaining air has been so far diminished that it is not able to open the valves. He opens the exhausting valves by a plug, which is pushed in by the hand; and the discharging valve is opened by a small pump placed on its outside, so that it opens into a void instead of opening against the pressure of the atmosphere. (See *Schotti Technica Curiosa*, p. 68. 70.). These contrivances have been lately added to air-pumps by Haas and Hurter as new inventions.

95 **Merits of Guericke.**

It must be acknowledged, that the application of the pump or syringe to the exhaustion of air was a very obvious thought on the principle exhibited in N° 17. and in this way it was also employed by Guericke, who first filled the receiver with water, and then applied the syringe. But this was by no means either his object or his principle. His object was not solely to procure a vessel void of air, but to exhaust the air which was already in it; and his principle was the power which he suspected to be in air of expanding itself into a greater space when the force was removed which he supposed to compress it. He expressly says (*Tract. de Experimentis Magdeburgicis, et in Epist. ad Schottum*), that the contrivance occurred to him accidentally when occupied with experiments in the Toricellian tube, in which he found that the air would really expand, and completely fill a much larger space than what it usually occupied, and that he had found no limits to the expansion, evincing this by facts which we shall perfectly understand by and by. This was a doctrine quite new, and required a philosophical mind to view it in a general and systematic manner; and it must be owned that his manner of treating the subject is equally remarkable for ingenuity and for modesty. (*Epist. ad Schottum*).

96 **Progress of experimental philosophy.**

His doctrine and his machine were soon spread over Europe. It was the age of literary ardour and philosophical curiosity; and it is most pleasant to us, who, standing on the shoulders of our predecessors, can see far around us, to observe the eagerness with which every new, and to us frivolous, experiment was repeated and canvassed. The worshippers of Aristotle were daily receiving severe mortifications from the experimenters, or empirics as they affected to call them, and they exerted themselves strenuously in support of his now tottering cause. This contributed to the rapid propagation of every discovery; and it was a most profitable and respectable business to go through the chief cities of Germany and France exhibiting philosophical experiments.

97 **Ardour of Mr Boyle.**

About this time the foundations of the Royal Society of London were laid. Mr Boyle, Mr Wren, Lord Brounker, Dr Wallis, and other curious gentlemen, held meetings at Oxford, in which were received accounts of whatever was doing in the study of nature; and many experiments were exhibited. The researches of Galileo, Toricelli, and Paschal, concerning the pressure of the air, greatly engaged their attention, and many additions were made to their discoveries. Mr Boyle, the most ardent and successful studier of nature, had the principal share in these improvements, his inquisitive mind being aided by an opulent fortune. In a letter to his nephew Lord Dungarvon, he says that he had made many attempts to see the appearances exhibited by bodies freed from the pressure of the air. He had made Toricellian tubes, having a small vessel a-top, into which he put some bodies before filling the tubes with mercury; so that when the tube was set upright, and the mercury run out, the bodies were *in vacuo*. He had also abstracted the water from a vessel, by a small pump, by means of its weight in the manner described in N° 17, having previously put bodies into the vessel along with the water. But all these ways were very troublesome and imperfect. He was delighted when he learned from Schottus's first publication, that Counsellor Guericke had effected this by the expansive power of the air; and immediately set about constructing a machine from his own ideas, no description of Guericke's being then published.

Plate CCCCIII. fig. 18.

98 **His air-pump.**

It consisted of a receiver A (fig. 18.), furnished with a stopcock B, and syringe CD placed in a vertical position below the receiver. Its valve C was in its bottom, close adjoining to the entry of the pipe of communication; and the hole by which the air issued was farther secured by a plug which could be removed. The piston was moved by a wheel and rackwork. The receiver of Guericke's pump was but ill adapted for any considerable variety of experiments; and accordingly very few were made in it. Mr Boyle's receiver had a large opening EF, with a strong glass margin. To this was fitted a strong brass cap, pierced with a hole G in its middle, to which was fitted a plug ground into it, and shaped like the key of a cock. The extremity of this key was furnished with a screw, to which could be affixed a hook, or a variety of pieces for supporting what was to be examined in the receiver, or for producing various motions within it, without admitting the air. This was farther guarded against by means of oil poured round the key, where it was retained by the hollow cup-like form of the cover. With all these precautions, however, Mr Boyle ingenuously confesses, that it was but seldom, and with great difficulty, that he could produce an extreme degree of rarefaction; and it appears by Guericke's letter to Schottus, that in this respect the Magdeburgh machine had the advantage. But most of Boyle's very interesting experiments did not require this extreme rarefaction; and the variety of them, and their philosophic importance, compensated for this defect, and soon eclipsed the fame of the inventor to such a degree, that the state of air in the receiver was generally denominated the *vacuum Boyleanum*, and the air-pump was called *machina Boyleana*. It does not appear that Guericke was at all solicitous to maintain his claim to priority of invention. He appears to have been of a truly noble and philosophical mind, aiming at nothing but the advancement of science.

99 **His contrivances to make vessels air-tight.**

Mr Boyle found, that to make a vessel air-tight, it was sufficient to place a piece of wet or oiled leather on its brim, and to lay a flat plate of metal upon this. The pressure of the external air squeezed the two solid bodies so hard together, that the soft leather effectually excluded it. This enabled him to render the whole machine incomparably more convenient for a variety of experiments. He caused the conduit-pipe to terminate in a flat plate which he covered with leather, and on this he set the glass ball or receiver, which had both its upper and lower brim ground flat. He covered the upper orifice in like manner with a piece of oiled leather and a flat plate, having cocks and a variety of other perforations and contrivances suited to his purposes. This he found infinitely more expeditious, and also tighter, than the clammy cements which he had formerly used for securing the joints.

100 **Dr Hooke's improvement of Boyle's air-pump.**

He was now assisted by Dr Hooke, the most ingenious and inventive mechanic that the world has ever seen. This person made a great improvement on the air-pump, by applying two syringes whose piston-rods were worked by

Fig. 20. by the same wheel, as in fig. 20. and putting valves in the pistons in the same manner as in the piston of a common pump. This evidently doubled the expedition of the pump's operation; but it also greatly diminished the labour of pumping: for it must be observed, that the piston H must be drawn up against the pressure of the external air, and when the rarefaction is nearly perfect this requires a force of nearly 15 pounds for every inch of the area of the piston. Now when one piston H is at the bottom of the barrel, the other K is at the top of the barrel, and the air below K is equally rare with that in the receiver. Therefore the pressure of the external air on the piston K is *nearly* equal to that on the piston H. Both, therefore, are acting in opposite directions on the wheel which gave them motion; and the force necessary for raising H is only the difference between the elasticity of the air in the barrel H and that of the air in the barrel K. This is very small in the beginning of the stroke, but gradually increases as the piston K descends, and becomes equal to the whole excess of the air's pressure above the elasticity of the remaining air of the receiver when the air at K of the natural density begins to open the piston valves. An accurate attention to the circumstances will show us that the force requisite for working the pump is greatest at first, and gradually diminishes as the rarefaction advances; and when this is nearly complete, hardly any more force is required than what is necessary for overcoming the friction of the pistons, except during the discharge of the air at the end of each stroke.

101 Generally adopted. This is therefore the form of the air-pump which is most generally used all over Europe. Some traces of national prepossession remain. In Germany, air-pumps are frequently made after the original model of Guericke's (Wolff Cyclomathesis); and the French generally use the pump made by Papin, though extremely awkward. We shall give a description of Boyle's air-pump as finally improved by Hawkesbee, which, with some small accommodations to particular views, still remains the most approved form.

102 Hawkesbee's improvements. Fig. 19. Here follows the description from Desaguliers.

It consists of two brass barrels *a a*, *a a* (fig. 19.), 12 inches high and 2 wide. The pistons are raised and depressed by turning the winch *b b*. This is fastened to an axis passing through a strong toothed wheel, which lays hold of the teeth of the racks *c c c c*. Then the one is raised while the other is depressed; by which means the valves, which are made of limber bladder, fixed in the upper part of each piston, as well as in the openings into the bottom of the barrels, perform their office of discharging the air from the barrels, and admitting into them the air from the receiver to be afterwards discharged; and when the receiver comes to be pretty well exhausted of its air, the pressure of the atmosphere in the descending piston is nearly so great, that the power required to raise the other is little more than is necessary for overcoming the friction of the piston, which renders this pump preferable to all others, which require more force to work them as the rarefaction of the air in the receiver advances.

103 Barrels. The barrels are set in a brass dish about two inches deep, filled with water or oil to prevent the insinuation of air. The barrels are screwed tight down by the nuts *e e*, *e e*, which force the frontispiece *f f* down on them, through which the two pillars *g g*, *g g* pass.

104 Brass pipe, &c. From between the barrels rises a slender brass pipe *h h*, communicating with each by a perforation in the transverse piece of brass on which they stand. The upper end of this pipe communicates with another perforated piece of brass, which screws on underneath the plate *i i i i*, of ten inches diameter, and surrounded with a brass rim to prevent the shedding of water used in some experiments. This piece of brass has three branches: 1st, An horizontal one communicating with the conduit pipe *h h*. 2d, An upright one screwed into the middle of the pump-plate, and terminating in a small pipe *k*, rising about an inch above it. 3d, A perpendicular one, looking downwards in the continuation of the pipe *k*, and having a hollow screw in its end receiving the brass cap of the gage-pipe *l l l l*, which is of glass, 34 inches long, and immersed in a glass cistern *m m* filled with mercury. This is covered a-top with a cork float, carrying the weight of a light wooden scale divided into inches, which are numbered from the surface of the mercury in the cistern. This scale will therefore rise and fall with the mercury in the cistern, and indicate the true elevation of that in the tube.

105 Stopcock. There is a stopcock immediately above the insertion of the gage-pipe, by which its communication may be cut off. There is another at *n*, by which a communication is opened with the external air, for allowing its readmission; and there is sometimes another immediately within the insertion of the conduct-pipe for cutting off the communication between the receiver and the pump. This is particularly useful when the rarefaction is to be continued long, as there are by these means fewer chances of the insinuation of air by the many joints.

106 Receivers. The receivers are made tight by simply setting them on the pump-plate with a piece of wet or oiled leather between; and the receivers which are open a-top, have a brass cover set on them in the same manner. In these covers there are various perforations and contrivances for various purposes. The one in the figure has a slip wire passing through a collar of oiled leather, having a hook or a screw in its lower end for hanging any thing on or producing a variety of motions.

107 Contrivance for removing them. Sometimes the receivers are set on another plate, which has a pipe screwed into its middle, furnished with a stopcock and a screw, which fits the middle pipe *k*. When the rarefaction has been made in it, the cock is shut, and then the whole may be unscrewed from the pump, and removed to any convenient place. This is called a *transporter plate.*

108 Principle upon which the gage is constructed. It only remains to explain the gage *l l l l*. In the ordinary state of the air its elasticity balances the pressure of the incumbent atmosphere. We find this from the force that is necessary to squeeze it into less bulk in opposition to this elasticity. Therefore the elasticity of the air increases with the vicinity of its particles. It is therefore reasonable to expect, that when we allow it to occupy more room, and its particles are farther asunder, its elasticity will be diminished though not annihilated; that is, it will no longer balance the WHOLE pressure of the atmosphere, though it may still balance part of it. If therefore an upright pipe have its lower end immersed in a vessel of mercury, and communicate by its upper end with a vessel containing rarefied, therefore less elastic, air, we should expect that the pressure of the air will prevail, and force the mercury into the tube, and cause it to rise to such a height that the

the weight of the mercury, joined to the elasticity of the rarefied air acting on its upper surface, shall be exactly equal to the whole pressure of the atmosphere. The height of the mercury is the exact measure of that part of the whole pressure which is not balanced by the elasticity of the rarefied air, and its deficiency from the height of the mercury in the Toricellian tube is the exact measure of the remaining elasticity.

109 so as to indicate the degree of rarefaction.

It is evident therefore, that the pipe will be a scale of the elasticity of the remaining air, and will indicate in some sort the degree of rarefaction: for there must be some analogy between the density of the air and its elasticity; and we have no reason to imagine that they do not increase and diminish together, although we may be ignorant of the law, that is, of the change of elasticity corresponding to a known change of density. This is to be discovered by experiment; and the air-pump itself furnishes us with the best experiments for this purpose. After rarefying till the mercury in the gage has attained half the height of that in the Toricellian tube, shut the communication with the barrels and gage, and admit the water into the receiver. It will go in till all is again in equilibrio with the pressure of the atmosphere; that is, till the air in the receiver has collapsed into its natural bulk. This we can accurately measure, and compare with the whole capicity of the receiver; and thus obtain the precise degree of rarefaction corresponding to half the natural elasticity. We can do the same thing with the elasticity reduced to one-third, one-fourth, &c. and thus discover the whole law.

110 Inconveniences of this gage,

The gage must be considered as one of the most ingenious and convenient parts of Hawkesbee's pump; and it is well disposed, being in a situation protected against accidents: but it necessarily increases greatly the size of the machine, and cannot be applied to the table-pump, represented in fig. 20. When it is wanted here, a small plate is added behind, or between the barrels and receiver: and on this is set a small tubulated (as it is termed) receiver, covering a common weather-glass tube.—This receiver being rarefied along with the other, the pressure on the mercury in the cistern arising from the elasticity of the remaining air is diminished so as to be no longer able to support the mercury at its full height; and it therefore descends till the height at which it stands puts it in equilibrio with the elasticity. In this form, therefore, the height of the mercury is directly a measure of the remaining elasticity; while in the other it measures the remaining unbalanced pressure of the atmosphere. But this gage is extremely cumbersome, and liable to accidents. We are seldom much interested in the rarefaction till it is great: a contracted form of this gage is therefore very useful, and was early used. A syphon ABCD (fig. 21.) each branch of which is about four inches long, close at A and open at D, is filled with boiling mercury till it occupies the branch AB and a very small part of CD, having its surface at O. This is fixed to a small stand, and fixed into the receiver, along with the things that are to be exhibited in the rarefied air. When the air has been rarefied till its remaining elasticity is not able to support the column BA, the mercury descends in AB, and rises in CD, and the remaining elasticity will always be measured by the elevation of the mercury in AB above that in the leg CD. Could the exhaustion be perfected, the surfaces in both legs would be on a level. Another gage might be put into the same foot, having a small bubble of air at A. This would move from the beginning of the rarefaction; but our ignorance of the analogy between the density and elasticity hinders us from using it as a measure of either.

Fig. 20.

111 remedied. Fig. 21.

It is enough for our present purpose to observe, that the barometer or syphon gage is a perfect indication and measure of the performance of an air-pump, and that a pump is (*cæteris paribus*) so much the more perfect, as it is able to raise the mercury higher in the gage. It is in this way that we discover that none can produce a complete exhaustion, and that their operation is only a very great rarefaction; for none can raise the mercury to that height at which it stands in the Toricellian tube, well purged of air. Few pumps will bring it within one-tenth of an inch. Hawkesbee's, fitted up according to his instructions, will seldom bring it within one-fifth. Pumps with cocks, when constructed according to the principles mentioned when speaking of the exhausting syringe, and new and in fine order, will in favourable circumstances bring it within one-fortieth. None with valves fitted up with wet leather, or when water or volatile fluids are allowed access into any part, will bring it nearer than one-fifth. Nay, a pump of the best kind, and in the finest order, will have its rarefying power reduced to the lowest standard, as measured by this gage, if we put into the receiver a tenth part of a square inch of white sheep skin, fresh from the shops, or of any substance equally damp. This is a discovery made by means of the improved air-pump, and leads to very extensive and important consequences in general physics; some of which will be treated of under this article: and the observation is made thus early, that our readers may better understand the improvements which have been made on this celebrated machine.

112 A complete exhaustion not effected by the air-pump.

113 Various improvements of this machine.

It would require a volume to describe all the changes which have been made on it. An instrument of such multifarious use, and in the hands of curious men, each diving into the secrets of nature in his favourite line, must have received many alterations and real improvements in many particular respects. But these are beside our present purpose; which is to consider it merely as a machine for rarefying elastic or expansive fluids. We must therefore confine ourselves to this view of it; and shall carefully state to our readers every improvement founded on principle, and on pneumatical laws.

114 by attempting to perfect the construction of the cocks.

All who used it perceived the limit set to the rarefaction by the resistance of the valves, and tried to perfect the construction of the cocks. The Abbé Nollet and Gravesande, two of the most eminent experimental philosophers in Europe, were the most successful.

115 Gravesande's improvements.

Mr Gravesande justly preferred Hooke's plan of a double pump, and contrived an apparatus for turning the cocks by the motion of the pump's handle. This is far from either being simple or easy in working; and occasions great jerks and concussions in the whole machine. This, however, is not necessarily connected with the truly pneumatical improvement. His piston has no valve, and the rod is connected with it by a stirrup D (fig. 22.), as in a common pump. The rod has a cylindric part *cp*, which passes through the stirrup, and has a stiff motion in it up and down of about half an inch; being stopped by the shoulder *c* above and the nut below. The round plate supported by this stirrup has a short square tube *n d*, which fits tight into the

Fig. 22.

116 **and manner of using it,**

the hole of a piece of cork F. The round plate E has a square shank *g*, which goes into the square tube *n d*. A piece of thin leather *f*, soaked in oil, is put between the cork and a plate E, and another between the cork and the plate which forms the sole of the stirrup. All these pieces are screwed together by the nail *e*, whose flat head covers the hole *n*. Suppose, therefore, the piston touching the bottom of the barrel, and the winch turning to raise it again, the friction of the piston on the barrel keeps it in its place, and the rod is drawn up through the stirrup D. Thus the wheel has liberty to turn about an inch; and this is sufficient for turning the cock, so as to cut off the communication with the external air, and to open the communication with the receiver. This being done, and the motion of the winch continued, the piston is raised to the top of the barrel. When the winch is turned in the opposite direction, the piston remains fixed till the cock is turned, so as to shut the communication with the receiver, and open that with the external air.

117 **a useful contrivance.**

This is a pretty contrivance, and does not at first appear necessary; because the cocks might be made to turn at the beginning and end of the stroke without it. But this is just possible; and the smallest error of adjustment, or wearing of the apparatus, will cause them to be open at improper times. Besides, the cocks are not turned in an instant, and are improperly open during some very small time; but this contrivance completely obviates this difficulty.

118

The cock is precisely similar to that formerly described, having one perforation diametrically through it, and another entering at right angles to this, and after reaching the centre, it passes along the axis of the cock, and comes out to the open air.

119 **Its inconveniences,**

It is evident, that by this construction of the cock, the ingenious improvement of Dr Hooke, by which the pressure of the atmosphere on one piston is made to balance (in great part) the pressure on the other, is given up: for, whenever the communication with the air is opened, it rushes in, and immediately balances the pressure on the upper side of the piston in this barrel; so that the whole pressure in the other must be overcome by the person working the pump. Gravesande, aware of this, put a valve on the orifice of the cock; that is, tied a slip of wet bladder or oiled leather across it, and now the piston is pressed down, as long as the air in the barrel is rarer than the outward air, in the same manner as when the valve is in the piston itself.

120 **remedied.**

121 **Highly extolled, but**

This is all that is necessary to be described in Mr Gravesande's air-pump. Its performance is highly extolled by him, as far exceeding his former pumps with valves. The same preference was given to it by his successor Muschenbroek. But, while they both prepared the pistons and valves and leathers of the pump, by steeping them in oil, and then in a mixture of water and spirits of wine, we are certain that no just estimate could be made of its performance. For with this preparation it could not bring the gage within one-fifth of an inch of the barometer. We even see other limits to its rarefaction: from its construction, it is plain that a very considerable space is left between the piston and cock, not less than an inch, from which the air is never expelled; and if this be made extremely small, it is plain that the pump must be worked very slow, otherwise there will not be time for the air to diffuse itself from the receiver into the barrel, especially towards the end, when the expelling force, viz. the elasticity of the remaining air, is very small. There is also the same limit to the rarefaction, as in Hooke's or Hawkesbee's pump, opposed by the valve E, which will not open till the air below the piston is considerably denser than the external air: and this pump soon lost any advantages it possessed when fresh from the workman's hands, by the cock's growing loose and admitting air. It is surprising that Gravesande omitted Hawkesbee's security against this, by placing the barrels in a dish filled with oil; which would effectually have prevented this inconvenience.

122 **limited in its operations.**

123 **In one respect inferior to Hawkesbee's.**

124 **Advantage of short barrels.**

We must not admit a seemingly paradoxical observation of Gravesande, that in a pump constructed with valves, and worked with a determined uniform velocity, the required degree of rarefaction is sooner produced by short barrels than by long ones. It would require too much time to give a general demonstration of this, but it will easily be seen by an example. Suppose the long barrel to have equal capacity with the receiver, then at the end of the first stroke the air in the receiver will have one-half its natural density. Now, let the short barrels have half this capacity: at the end of the first stroke the density of the air in the receiver is two-thirds, and at the end of the second stroke it is four-ninths, which is less than one-half, and the two strokes of the short barrel are supposed to be made in the same time with one of longest, &c.

125 **Smeaton improves the valve-pump**

Hawkesbee's pump maintained its pre-eminence without rival in Britain, and generally too on the continent, except in France, where every thing took the *ton* of the Academy, which abhorred being indebted to foreigners for any thing in science, till about the year 1750, when it engaged the attention of Mr John Smeaton, a person of uncommon knowledge, and second to none but Dr Hooke in sagacity and mechanical resource. He was then a maker of philosophical instruments, and made many attempts to perfect the pumps with cocks, but found, that whatever perfection he could bring them to, he could not enable them to preserve it; and he never would sell one of this construction. He therefore attached himself solely to the valve pumps.

126 **by enlarging the valve-hole,**

The first thing was to diminish the resistance to the entry of the air from the receiver into the barrels: this he rendered almost nothing, by enlarging the surface on which this feebly elastic air was to press. Instead of making these valves to open by its pressure on a circle of one-twentieth of an inch in diameter, he made the valve-hole one inch in diameter, enlarging the surface 400 times; and, to prevent this piece of thin leather from being burst by the great pressure on it, when the piston in its descent was approaching the bottom of the barrel, he supported it by a delicate but strong grating, dividing the valve-hole like the section of a honey-comb, as represented in fig. 25.; and the ribs of this grating are seen edgewise in fig. 23. at *a b c*.

Fig. 25.
Fig. 23.

127 **changing the structure of the valve, and**

The valve was a piece of thin membrane or oiled silk, gently strained over the mouth of the valve-hole, and tied on by a fine silk thread wound round it in the same manner that the narrow slips had been tied on formerly. This done, he cut with a pointed knife the leather round the edge, nearly four quadrantal arcs, leaving a small tongue between each, as in fig. 25. The strained valve immediately shrinks inwards, as repre-

Fig. 25.

sented

ed by the shaded parts; and the strain by which it is kept down is now greatly diminished, taking place only at the corners. The gratings being reduced nearly to an edge (but not quite, lest they should cut), there is very little pressure to produce adhesion by the clammy oil. Thus it appears, that a very small elasticity of the air in the receiver will be sufficient to raise the valve; and Mr Smeaton found, that when it was not able to do this at first, when only about $\frac{1}{600}$ of the natural elasticity, it would do it after keeping the piston up eight or ten seconds, the air having been all the while undermining the valve, and gradually detaching it from the grating.

128 increasing the expelling force.

Unfortunately he could not follow this method with the piston valve. There was not room round the rod for such an expanded valve; and it would have obliged him to have a great space below the valve, from which he could not expel the air by the descent of the piston. His ingenuity hit on a way of increasing the expelling force through the common valve: he inclosed the rod of the piston in a collar of leather *l*, through which it moved freely without allowing any air to get past its sides. For greater security, the collar of leather was contained in a box terminating in a cup filled with oil. As this makes a material change in the principle of construction of the air-pump (and indeed of pneumatic engines in general), and as it has been adopted in all the subsequent attempts to improve them, it merits a particular consideration.

129 Structure of his piston for this purpose. Fig. 23.

The piston itself consists of two pieces of brass fastened by screws from below. The uppermost, which is of one solid piece with the rod GH (fig. 23.) is of a diameter somewhat less than the barrel; so that when they are screwed together, a piece of leather soaked in a mixture of boiled oil and tallow, is put between them; and when the piston is thrust into the barrel from above, the leather comes up around the side of the piston, and fills the barrel, making the piston perfectly air-tight. The lower half of the piston projects upwards into the upper, which has a hollow *g b c d* to receive it. There is a small hole through the lower half at *a* to admit the air; and a hole *c d* in the upper half to let it through, and there is a slip of oiled silk strained across the hole *a* by way of valve, and there is room enough left at *b c* for this valve to rise a little when pressed from below. The rod GH passes through the piece of brass which forms the top of the barrel so as to move freely, but without any sensible shake: this top is formed into a hollow box, consisting of two pieces ECDF and CNOD, which screw together at CD. This box is filled with rings of oiled leather exactly fitted to its diameter, each having a hole in it for the rod to pass through. When the piece ECDF is screwed down, it compresses the leathers; squeezing them to the rod, so that no air can pass between them; and, to secure us against all ingress of air, the upper part is formed into a cup EF, which is kept filled with oil.

The top of the barrel is also pierced with a hole LK, which rises above the flat surface NO, and has a slip of oiled silk tied over it to act as a valve; opening when pressed from below, but shutting when pressed from above.

The communication between the barrel and receiver is made by means of the pipe ABPQ; and there goes from the hole K in the top of the barrel a pipe KRST, which either communicates with the open air or with the receiver, by means of the cock at its extremity T. The conduit pipe ABPQ has also a cock at Q, by which it is made to communicate either with the receiver or with the open air. These channels of communication are variously conducted and terminated, according to the views of the maker: the sketch in this figure is sufficient for explaining the principle, and is suited to the general form of the pump, as it has been frequently made by Nairne and other artists in London.

130 Superiority of this construction,

Let us now suppose the piston at the top of the barrel, and that it applies to it all over, and that the air in the barrel is very much rarefied: in the common pump the piston valve is pressed hard down by the atmosphere, and continues shut till the piston gets far down, condenses the air below it beyond its natural state, and enables it to force up the valves. But here, as soon as the piston quits the top of the barrel, it leaves a void behind it; for no air gets in round the piston rod, and the valve at K is shut by the pressure of the atmosphere. There is nothing now to oppose the elasticity of the air below but the stiffness of the valve *b c*; and thus the expelling (or more accurately the liberating) force is prodigiously increased.

131 shown by an example.

The superiority of this construction will be best seen by an example. Suppose the stiffness of the valve equal to the weight of $\frac{1}{10}$th of an inch of mercury, when the barometer stands at 30 inches, and that the pump-gage stands at 29.9; then, in an ordinary pump, the valve in the piston will not rise till the piston has got within the 300th part of the bottom of the barrel, and it will leave the valve-hole filled with air of the ordinary density. But in this pump the valve will rise as soon as the piston quits the top of the barrel; and when it is quite down, the valve-hole *a* will contain only the 300th part of the air which it would have contained in a pump of the ordinary form. Suppose farther, that the barrel is of equal capacity with the receiver, and that both pumps are so badly constructed, that the space left below the piston is the 300th part of the barrel. In the common pump the piston valve will rise no more, and the rarefaction can be carried no farther, however delicate the barrel valve may be; but in this pump the next stroke will raise the gage to 29.95, and the piston valve will again rise as soon as the piston gets half way down the barrel.

The limit to the rarefaction by this pump depends chiefly on the space contained in the hole LK, and in the space *bcd* of the piston. When the piston is brought up to the top, and applied close to it, those spaces remain filled with air of the ordinary density, which will expand as the piston descends, and thus will retard the opening of the piston valve. The rarefaction will stop when the elasticity of this small quantity of air, expanded so as to fill the whole barrel (by the descent of the piston to the bottom), is just equal to the force requisite for opening the piston valve.

132 It is easily worked.

Another advantage attending this construction is, that in drawing up the piston, we are not resisted by the whole pressure of the air; because the air is rarefied above this piston as well as below it, and the piston is in precisely the same state of pressure as if connected with another piston in a double pump. The resistance to the ascent of the piston is the excess of the elasticity of the air above it over the elasticity of the air below:

this, toward the end of the rarefaction, is very small, while the piston is near the bottom of the barrel, but gradually increases as the piston rises, and reduces the air above it into smaller dimensions, and becomes equal to the pressure of the atmosphere, when the air above the piston is of the common density. If we should raise the piston still farther, we must condense the air above it: but Mr Smeaton has here made an issue for the air by a small hole in the top of the barrel, covered with a delicate valve. This allows the air to escape, and shuts again as soon as the piston begins to descend, leaving almost a perfect void behind it as before.

This pump has another advantage. It may be changed in a moment from a rarefying to a condensing engine, by simply turning the cocks at Q and T. While T communicates with the open air and Q with the receiver, it is a rarefying engine or air-pump: but when T communicates with the receiver, and Q with the open air, it is a condensing engine.

Plate ccccxxvi. fig. 26.

133 Description of Smeaton's pump.

Fig. 26. represents Mr Smeaton's air-pump as it is usually made by Nairne. Upon a solid base or table are set up three pillars F, H, H: the pillar F supports the pump-plate A; and the pillars H, H, support the front or head, containing a brass cog-wheel, which is turned by the handle B, and works in the rack C fastened to the upper end of the piston rod. The whole is still farther steadied by two pieces of brass *c b* and *o k*, which connect the pump-plate with the front, and have perforations communicating between the hole *a* in the middle of the plate and the barrel, as will be described immediately. DE is the barrel of the pump, firmly fixed to the table by screws through its upper flanch: *e f d c* is a slender brass tube screwed to the bottom of the barrel, and to the under hole of the horizontal canal *c b*. In this canal there is a cock which opens a communication between the barrel and the receiver, when the key is in the position represented here: but when the key is at right angles with this position, this communication is cut off. If that side of the key which is here drawn next to the pump-plate be turned outward, the external air is admitted into the receiver; but if turned inwards, the air is admitted into the barrel.

g h Is another slender brass pipe, leading from the discharging valve at *g* to the horizontal canal *h k*, to the under side of which it is screwed fast. In this horizontal canal there is a cock *n* which opens a passage from the barrel to the receiver when the key is in the position here drawn; but opens a passage from the barrel to the external air when the key is turned outwards, and from the receiver to the external air when the key is turned inwards. This communication with the external air is not immediate but through a sort of box *i*; the use of this box is to receive the oil which is discharged through the top valve *g*. In order to keep the pump tight, and in working order, it is proper sometimes to pour a table-spoonful of olive oil into the hole *a* of the pump-plate, and then to work the pump. The oil goes along the conduit *b c d f e*, gets into the barrel and through the piston-valve, when the piston is pressed to the bottom of the barrel, and is then drawn up, and forced through the discharging valve *g* along the pipe *g h*, the horizontal passage *h n*, and finally into the box *i*. This box has a small hole in its side near the top, through which the air escapes.

From the upper side of the canal *c b* there arises a slender pipe which bends outward and then turns downwards, and is joined to a small box, which cannot be seen in this view. From the bottom of this box proceeds downwards the gage-pipe of glass, which enters the cistern of mercury G fixed below.

On the upper side of the other canal at *o* is seen a small stud, having a short pipe of glass projecting horizontally from it, close by and parallel to the front piece of the pump, and reaching to the other canal. This pipe is close at the farther end, and has a small drop of mercury or oil in it at the end *o*. This serves as a gage in condensing, indicating the degree of condensation by the place of the drop: For this drop is forced along the pipe, condensing the air before it in the same degree that it is condensed in the barrel and receiver.

134 Method of joining together the different pipes, &c.

In constructing this pump, Mr Smeaton introduced a method of joining together the different pipes and other pieces, which has great advantages over the usual manner of screwing them together with leather between, and which is now much used in hydraulic and pneumatic engines. We shall explain this to our readers by a description of the manner in which the exhausting gage is joined to the horizontal duct *c b*.

Fig. 23. Fig. 26.

The piece *h i p*, in fig. 23. is the same with the little cylinder observable on the upper side of the horizontal canal *c d*, in fig. 26. The upper part *h i* is formed into an outside screw, to fit the hollow screw of the piece *d e e d*. The top of this last piece has a hole in its middle, giving an easy passage to the bent tube *c b a*, so as to slip along it with freedom. To the end *c* of this bent tube is soldered a piece of brass *c f g*, perforated in continuation of the tube, and having its end ground flat on the top of the piece *h i p*, and also covered with a slip of thin leather strained across it and pierced with a hole in the middle.

It is plain from this form, that if the surface *f g* be applied to the top of *h i*, and the cover *d e e d* be screwed down on it, it will draw or press them together, so that no air can escape by the joint, and this without turning the whole tube *c b a* round, as is necessary in the usual way. This method is now adopted for joining together the conducting pipes of the machines for extinguishing fires, an operation which was extremely troublesome before this improvement.

Fig. 26.

The conduit pipe E *e f c* (fig. 26.) is fastened to the bottom of the barrel, and the discharging pipe *g h* to its top, in the same manner. But to return to the gage; the bent pipe *c b a* enters the box *s t* near one side, and obliquely, and the gage pipe *q r* is inserted through its bottom towards the opposite side. The use of this box is to catch any drops of mercury which may sometimes be dashed up through the gage pipe by an accidental oscillation. This, by going through the passages of the pump, would corrode them, and would act particularly on the joints, which are generally soldered with tin. When this happens to an air-pump, it must be cleaned with the most scrupulous attention, otherwise it will be quickly destroyed.

135 Great powers of this pump. Fig. 27.

This account of Smeaton's pump is sufficient for enabling the reader to understand its operation and to see its superiority. It is reckoned a very fine pump of the ordinary construction which will rarefy 200 times, or raise the gage to 29.85, the barometer standing at 30. But Mr Smeaton found, that his pump, even after long using, raised it to 29.95, which we consider as equivalent

lent to rarefying 600 times. When in fine order, he found no bounds to its rarefaction, frequently raising the gage as high as the barometer; and he thought its performance so perfect, that the barometer-gage was not sufficiently delicate for measuring the rarefaction. He therefore substituted the syphon gage already described, which he gives some reasons for preferring; but even this he found not sufficiently sensible.

136
Another contrivance of Smeaton's
Fig. 27.

He contrived another, which could be carried to any degree of sensibility. It consists of a glass body A (fig. 27.), of a pear shape, and was therefore called the pear-gage. This had a small projecting orifice at B, and at the other end a tube CD, whose capacity was the hundredth part of the capacity of the whole vessel. This was suspended at the slip-wire of the receiver, and there was set below it a small cup with mercury. When the pump was worked, the air in the pear-gage was rarefied along with the rest. When the rarefaction was brought to the degree intended, the gage was let down till B reached the bottom of the mercury. The external air being now let in, the mercury was raised into the pear, and stood at some height E in the tube CD. The length of this tube being divided into 100 parts, and those numbered from D, it is evident that $\frac{DE}{DB}$ will express the degree of rarefaction which had been produced when the gage was immersed into the mercury: or if DC be $\frac{1}{100}$ of the whole capacity, and be divided into 100 parts by a scale annexed to it, each unit of the scale will be $\frac{1}{10000}$ of the whole.

137
very ingenious.

This was a very ingenious contrivance, and has been the means of making some very curious and important discoveries which at present engage the attention of philosophers. By this gage Mr Smeaton found, that his pump frequently rarefied a thousand, ten thousand, nay an hundred thousand times. But though he in every instance saw the great superiority of his pump above all others, he frequently found irregularities which he could not explain, and a want of correspondence between the pear and the barometer gages which puzzled him. The pear-gage frequently indicated a prodigious rarefaction, when the barometer-gage would not show more than 600.

138
It excited the attention of the literary world.

These unaccountable phenomena excited the curiosity of philosophers, who by this time were making continual use of the air-pump in their meteorological researches, and much interested in every thing connected with the state or constitution of elastic fluids. Mr Nairne, a most ingenious and accurate maker of philosophical instruments, made many curious experiments in the examination and comparison of Mr Smeaton's pump with those of the usual construction, attending to every circumstance which could contribute to the inferiority of the common pumps or to their improvement, so as to bring them nearer to this rival machine. This rigorous comparison brought into view several circumstances in the constitution of the atmospheric air, and its relation to other bodies, which are of the most extensive and important influence in the operations of nature. We shall notice at present such only as have a relation to the operation of the air-pump in extracting AIR from the receiver.

139
Experiments with it by Mr Nairne

Mr Nairne found, that when a little water, or even bit of paper damped with water, was exposed under the receiver of Mr Smeaton's air-pump, when in the most perfect condition, raising the mercury in the barometer-gage to 29.95, he could not make it rise above 29.8 if Fahrenheit's thermometer indicated the temperature 47°, nor above 29.7 if the thermometer stood at 55°; and that to bring the gage to this height and keep it there, the operation of the pump must be continued for a long time after the water had disappeared or the paper become perfectly dry. He found that a drop of spirits, or paper moistened with spirits, could not in those circumstances allow the mercury in the gage to rise to near that height; and that similar effects followed from admitting any volatile body whatever into the receiver or any part of the apparatus.

140
shows the impropriety of soaking the leather with water,

This showed him at once how improper the directions were which had been given by Guericke, Boyle, Gravesande, and others, for fitting up the air-pump for experiment, by soaking the leather in water, covering the joints with water, or in short, admitting water or any other volatile body near it.

141
and the utility of using olive oil and tallow.

He therefore took his pumps to pieces, cleared them of all the moisture which he could drive from them by heat, and then leathered them anew with leather soaked in a mixture of olive oil and tallow, from which he had expelled all the water it usually contains, by boiling it till the first frothing was over. When the pumps were fitted up in this manner, he uniformly found that Mr Smeaton's pump rarefied the gage to 29.95, and the best common pump to 29.87, the first of whom he computed to indicate a rarefaction to 600, and the other to 230. But in this state he again found that a piece of damp paper, leather, wood, &c. in the receiver, reduced the performance in the same manner as before.

142
A remarkable phenomenon

But the most remarkable phenomena was, that when he made use of the pear-gage with the pump cleared from all moisture, it indicated the same degree of rarefaction with the barometer gage: but when he exposed a bit of paper moistened with spirits, and thus reduced the rarefaction of the pump to what he called 50, the barometer gage standing at 29.4, the pear-gage indicated a rarefaction exceeding 100,000; in short, it was not measurable; and this phenomenon was almost constant. Whenever he exposed any substance susceptible of evaporation, he found the rarefaction indicated by the barometer-gage greatly reduced, while that indicated by the pear-gage was prodigiously increased; and both these effects were more remarkable as the subject was of easier evaporation, or the temperament of the air of the chamber was warmer.

143
accounted for.

This uniform result suggested the true cause. Water boils at the temperature 212, that is, it is then converted into a vapour which is permanently elastic while of that temperature, and its elasticity balances the pressure of the atmosphere. If this pressure be diminished by rarefying the air above it, a low temperature will not allow it to be converted into elastic vapour, and keep it in that state. Water will boil in the receiver of an air-pump at the temperature 96, or even under it. Philosophers did not think of examining the state of the vapour in temperatures lower than what produced ebullition. But it now appears, that in much lower heats than this the superficial water is converted into elastic vapour, which continues to exhale from it as long as the water lasts, and, supplying the place of air in the receiver, exerts the same elasticity, and hinders the mercury from rising in the gage in the same manner as so much air of equal elasticity would have done.

144 Experiments illustrating this account.

When Mr Nairne was exhibiting these experiments to the Honourable Henry Cavendish in 1776, this gentleman informed him that it appeared from a series of experiments of his father Lord Charles Cavendish, that when water is of the temperature 72°, it is converted into vapour, under any pressure less than three-fourths of an inch of mercury, and at 41° it becomes vapour when the pressure is less than one-fourth of an inch: Even mercury evaporates in this manner when all pressure is removed. A dewy appearance is frequently observed covering the inside of the tube of a barometer, where we usually suppose a vacuum. This dew, when viewed through a microscope, appears to be a set of detached globules of mercury, and upon inclining the tube so that the mercury may ascend along it, these globules will be all licked up, and the tube become clear. The dew which lined it was the vapour of the mercury condensed by the side of the tube; and it is never observed but when one side is exposed to a stream of cold air from a window, &c.

To return to the vapour in the air-pump receiver, it must be observed, that as long as the water continues to yield it, we may continue to work the pump; and it will be continually abstracted by the barrels, and discharged in the form of water, because it collapses as soon as exposed to the external pressure. All this while the gage will not indicate any more rarefaction, because the thing immediately indicated by the barometer-gage is *diminished elasticity*, which does not happen here. When all the water which the temperature of the room can keep elastic has evaporated under a certain pressure, suppose $\frac{1}{2}$ an inch of mercury, the gage standing at 29.5, the vapour which now fills the receiver expands, and by its diminished elasticity the gage rises, and now some more water which had been attached to bodies by chemical or corpuscular attraction is detached, and a new supply continues to support the gage at a greater height; and this goes on continually till *almost* all has been abstracted: but there will remain some which no art can take away; for as it passes through the barrels, and gets between the piston and the top, it successively collapses into water during the ascent of the piston, and again expands into vapour when we push the piston down again. Whenever this happens there is an end of the rarefaction.

145 Air and vapour not uniformly mixed together.

While this operation is going on, the air comes out along with the vapour; but we cannot say in what proportion. If it were always uniformly mixed with the vapour, it would diminish rapidly; but this does not appear to be the case. There is a certain period of rarefaction in which a transient cloudiness is perceived in the receiver. This is watery vapour formed at that degree of rarefaction, mingled with, but not dissolved in or united with, the air, otherwise it would be transparent. A similar cloud will appear if damp air be admitted suddenly into an exhausted receiver. The vapour, which formed an uniform transparent mass with the air, is either suddenly expanded and thus detached from the other ingredient, or is suddenly let go by the air, which expands more than it does. We cannot affirm with probability which of these is the case: different compositions of air, that is, air loaded with vapours from different substances, exhibit remarkable differences in this respect. But we see from this and other phenomena, which shall be mentioned in their proper places, that the air and vapour are not always intimately united; and therefore will not always be drawn out together by the air-pump. But let them be ever so confusedly blended, we see that the air must come out along with the vapour, and its quantity remaining in the receiver must be prodigiously diminished by this association, probably much more than could be, had the receiver only contained pure air.

146 Consequences of this different in the pear and barometer gages.

Let us now consider what must happen in the pear-gage. As the air and vapour are continually drawn off from the receiver, the air in the pear expands and goes off with it. We shall suppose that the generated vapour hinders the gage from rising beyond 29.5. During the continued working of the pump, the air in the pear, whose elasticity is 0.5, slowly mixes with the vapour at the mouth of the pear, and the mixture even advances into its inside, so that if the pumping be long enough continued, what is in the pear is nearly of the same composition with what is in the receiver, consisting perhaps of 20 parts of vapour and one part of air, all of the elasticity of 0.5. When the pear is plunged into the mercury, and the external air allowed to get into the receiver, the mercury rises in the pear-gage, and leaves not $\frac{1}{60}$, but $\frac{1}{60 \times 20}$ or $\frac{1}{1200}$ of it filled with common air, the vapour having collapsed into an invisible atom of water. Thus the pear-gage will indicate a rarefaction of 1200, while the barometer-gage only showed 60, that is, showed the elasticity of the included substance diminished 60 times. The conclusion to be drawn from these two measures (the one of the rarefaction of air, and the other of the diminution of elasticity) is, that the matter with which the receiver was filled, immediately before the readmission of the air, consisted of one part of incondensible air, and $\frac{1200}{60}$, or 20 parts of watery vapour.

147 Difficulty in accounting for some of these consequences.

The only obscure part of this account is what relates to the composition of the matter which filled the pear-gage before the admission of the mercury. It is not easy to see how the vapour of the receiver comes in by a narrow mouth while the air is coming out by the same passage. Accordingly it requires a *very long time* to produce this extreme rarefaction in the pear-gage; and there are great irregularities in any two succeeding experiments, as may be seen by looking at Mr Nairne's account of them in the Philosophical Transactions, vol. lxvii. Some vapours appear to have mixed much more readily with the air than others; and there are some unaccountable cases where vitriolic acid and sulphureous bodies were included, in which the diminution of density indicated by the pear-gage was uniformly less than the diminution of elasticity indicated by the barometer-gage. It is enough for us at present to have established, by unquestionable facts, this production of elastic vapour, and the necessity of attending to it, both in the construction of the air-pump and in drawing results from experiments exhibited in it.

148 The superiority of this pump excites two new improvements.

Mr Smeaton's pump, when in good order, and perfectly free from all moisture, will in dry weather rarefy air about 600 times, raising the barometer-gage to within $\frac{1}{20}$ of an inch of a fine barometer. This was a performance so much superior to that of all others, and by means of Mr Nairne's experiments opened so new a field of observation, that the air-pump once more became a capital instrument among the experimental philosophers. The causes of its superiority were also so distinct, that artists were immediately excited to a farther improvement of the machine; so that this becomes a new epoch in its history.

149 Improvements in this pump attempted.

There is one imperfection which Mr Smeaton has not attempted to remove. The discharging valve is still opened against the pressure of the atmosphere. An author of the Swedish academy adds a subsidiary pump to this valve, which exhausts the air from above it, and thus puts it in the situation of the piston valve. We do not find that this improvement has been adopted so as to become general. Indeed the quantity of air which remains in the passage to this valve is so exceedingly little, that it does not seem to merit attention. Supposing the valve hole $\frac{1}{20}$ of an inch wide and as deep (and it need not be more), it will not occupy more than $\frac{1}{9600}$ part of a barrel twelve inches long and two inches wide.

150

Mr Smeaton, by his ingenious construction, has greatly diminished, but has not annihilated, the obstructions to the passage of the air from the receiver into the barrel. His success encouraged farther attempts. One of the first and most ingenious was that of Professor Russel of the university of Edinburgh, who about the year 1770 constructed a pump in which both cocks and valves were avoided.

151 by Russel, Fig. 28.

The piston is solid, as represented in fig. 28. and its rod passes through a collar of leather on the top of the barrel. This collar is divided into three portions by two brass rings *a*, *b*, which leave a very small space round the piston rod. The upper ring *a* communicates by means of a lateral perforation with the bent tube *l m n*, which enters the barrel at its middle *n*. The lower ring *b* communicates with the bent tube *c d*, which communicates with the horizontal passage *d c*, going to the middle *e* of the pump-plate. By the way, however, it communicates also with a barometer gage *p o*, standing in a cistern of mercury *o*, and covered with a glass tube close at the top. Beyond *e*, on the opposite circumference of the receiver plate, there is a cock or plug *f* communicating with the atmosphere.

The piston rod is closely embraced by the three collars of leather; but, as already said, has a free space round it in the two brass rings. To produce this pressure of the leathers to the rod, the brass rings which separate them are turned thinner on the inner side, so that their cross section along a diameter would be a taper wedge. In the side of the piston rod are two cavities *q r*, *t s*, about one-tenth of an inch wide and deep, and of a length equal to the thickness of the two rings *a*, *b*, and the intermediate collar of leathers. These cavities are so placed on the piston-rod, that when the piston is applied to the bottom of the barrel, the cavity *t s* in the upper end of the rod has its upper end opposite to the ring *a*, and its lower end opposite to the ring *b*, or to the mouth of the pipe *c d*. Therefore, if there be a void in the barrel, the air from the receiver will come from the pipe *c d*, into the cavity in the piston rod, and by it will get past the collar of leather between the rings, and thus will get into the small interstice between the rod and the upper ring, and then into the pipe *l m n*, and into the empty barrel. When the piston is drawn up, the solid rod immediately shuts up this passage, and the piston drives the air through the discharging valve *k*. When it has reached the top of the barrel, and is closely applied to it, the cavity *q r* is in the situation in which *t s* formerly was, and the communication is again opened between the receiver and the empty barrel, and the air is again diffused between them. Pushing down the piston expels the air by the lower discharging pipe and valve *h i*; and thus the operation may be continued.

This must be acknowledged to be a most simple and ingenious construction, and can neither be called a cock nor a valve. It seems to oppose no obstruction whatever: and it has the superior advantage of rarefying both during the ascent and the descent of the piston, doubling the expedition of the performance, and the operator is not opposed by the pressure of the atmosphere except towards the end of each stroke. The expedition, however, is not so great as one should expect; for nothing is going on while the piston is in motion, and the operator must stop a while at the end of each stroke, that the air may have time to come through this long, narrow, and crooked passage, to fill the barrel. But the chief difficulty which occurred in the execution arose from the clammy oil with which it was necessary to impregnate the collar of leathers. These were always in a state of strong compression, that they might closely grasp the piston rod, and prevent all passage of air during the motion of the piston. Whenever therefore the cavities in the piston rod come into the situations necessary for connecting the receiver and barrel, this oil is squeezed into them, and chokes them up. Hence it always happened that it was some time after the stroke before the air could force its way round the piston rod, carrying with it the clammy oil which choked up the tube *l m n*; and when the rarefaction had proceeded a certain length, the diminished elasticity of the air was not able to make its way through these obstructions. The death of the ingenious author put a stop to the improvements by which he hoped to remedy this defect, and we have not heard that any other person has since attempted it. We have inserted it here, because its principle of construction is not only very ingenious, but entirely different from all others, and may furnish very useful hints to those who are much engaged in the construction of pneumatic engines.

152 By Haas and Hurter.

In the 73d volume of the Philosophical Transactions, Mr Tiberius Cavallo has given the description of an air-pump contrived and executed by Messrs Haas and Hurter, instrument-makers in London, where these artists have revived Guericke's method of opening the barrel valve during the last strokes of the pump by a force acting from without. We shall insert so much of this description as relates to this distinguishing circumstance of its construction.

Fig. 29.

Fig. 29. represents a section of the bottom of the barrel, where AA is the barrel and BB the bottom, which has in its middle a hollow cylinder CCFF, projecting about half an inch into the barrel at CC, and extending a good way downwards to FF. The space between this projection and the sides of the barrel is filled up by a brass ring DD, over the top of which is strained a piece of oiled silk EE, which performs the office of a valve, covering the hole CC. But this hole is filled up by a piece of brass, or rather an assemblage of pieces screwed together, GGHHII. It consists of three projecting fillets or shoulders GG, HH, II, which form two hollows between them, and which are filled with rings of oiled leather OO, PP, firmly screwed together. The extreme fillets GG, II, are of equal diameter with the inside of the cylinder, so as to fill it exactly, and the whole stuffed with oiled leather, slide up and down without allowing any air to pass. The middle fillet HH is not so broad, but thicker. In the upper fillet GG there is formed a shallow dish about $\frac{1}{8}$ of an inch deep and $\frac{1}{4}$ wide. This dish is covered with a thin plate, pierced with a grating like Mr Smeaton's valve-plate. There is a perforation VX along the axis of this piece, which has a passage out at one side H, through the middle fillet. Opposite to this passage, and in the side of the cylinder CCFF, is a hole M, communicating with the conduit pipe MN, which leads to the receiver. Into the lower end of the perforation is screwed the pin KL, whose tail L passes through the cap FF. The tail L is connected with a lever RQ, moveable round the joint Q. This lever is pushed upwards by a spring, and thus the whole piece which we have been describing is kept in contact with the slip of oiled silk or valve EE. This is the usual situation of things.

153 Now suppose a void formed in the barrel by drawing up the piston; the elasticity of the air in the receiver, in the pipe NM, and in the passage XV, will press on the great surface of the valve exposed through the grating, will raise it, and the pump will perform precisely as Mr Smeaton's does. But suppose the rarefaction to have been so long continued, that the air is no longer able to raise the valve; this will be seen by the mercury rising no more in the pump-gage. When this is perceived, the operator must press with his foot on the end R of the lever RQ. This draws down the pin KL, and with it the whole hollow plug with its grated top. And thus, instead of raising the valve from its plate, the plate is here drawn down from the valve. The air now gets in without any obstruction whatever, and the rarefaction proceeds as long as the piston rises. When it is at the top of the barrel, the operator takes his foot from the lever, and the spring presses up the plug again and shuts the valve. The piston rod passes through a collar of leather, as in Mr Smeaton's pump, and the air is finally discharged through an outward valve in the top of the barrel. These parts have nothing peculiar in them.

This is an ingenious contrivance, similar to what was adapted by Guericke himself; and we have no doubt of these pumps performing extremely well if carefully made: and it seems not difficult to keep the plug perfectly air-tight by supplying plenty of oil to the leathers. We cannot say, however, with precision what may be expected from it, as no account has been given of its effects besides what Mr Cavallo published in Philosophical Transactions 1783, where he only says, that when it had been long used, it had, in the course of some experiments, rarefied 600 times.

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by Prince, Aiming still at the removing the obstructions to the entry of the air from the receiver into the barrels, Mr Prince, an American, has constructed a pump in which there is no valve or cock whatever between them. In this pump the piston rod passes through a collar of leathers, and the air is finally discharged through a valve, as in the two last. But we are chiefly to attend, in this place, to the communication between the barrel and the receiver. The barrel widens below into a sort of cistern ABCD (fig. 30.), communicating with the receiver by the pipe EF. Fig. 30. As soon, therefore, as the piston gets into this wider part, where there is a vacancy all round it, the air of the receiver expands freely through the passage FEE into the barrel, in which the descent of the piston had made a void. When the piston is again drawn up, as soon as it gets into the cylindric part of the barrel, which it exactly fills, it carries up the air before it, and expels it by the top valve; and, that this may be done more completely, this valve opens into a second barrel or air-pump whose piston is rising at the same time, and therefore the valve of communication (which is the discharging valve of the primary pump) opens with the same facility as Mr Smeaton's piston valve. While the piston is rising, the air in the receiver expands into the barrel; and when the piston descends, the air in the barrel again collapses till the piston gets again into the cistern, when the air passes out, and fills the evacuated barrel, to be expelled by the piston as before.

No distinct account has as yet been given of the performance of this pump. We only learn that great inconveniencies were experienced from the oscillations of the mercury in the gage. As soon as the piston comes into the cistern, the air from the receiver immediately rushes into the barrel, and the mercury shoots up in the gage, and gets into a state of oscillation. The subsequent rise of the piston will frequently keep time with the second oscillation, and increase it. The descent of the piston produces a downward oscillation, by allowing the air below it to collapse; and, by improperly timing the strokes, this oscillation becomes so great as to make the mercury enter the pump. To prevent this, and a greater irregularity of working as a condenser, valves were put in the piston: but as these require force to open them, the addition seemed rather to increase the evil, by rendering the oscillations more simultaneous with the ordinary rate of working. If this could be got over, the construction seems very promising.

It appears, however, of very difficult execution. It has many long, slender, and crooked passages, which must be drilled through broad plates of brass, some of them appearing scarcely practicable. It is rare to find plates and other pieces of brass without air-holes, which it would be very difficult to find out and to close; and it must be very difficult to clear it of obstructions; so that it appears rather a suggestion of theory than a thing warranted by its actual performance.

Mr Lavoisier, or some of the naturalists who were occupied in concert with him in the investigation of the different species of gas which are disengaged from bodies in the course of chemical operations, has contrived an air-pump which has great appearance of simplicity, and, being very different from all others, deserves to be taken notice of. 155
by Lavoisier.

It consists of two barrels *l*, *m*, fig. 31. with solid pistons *k k*. Fig. 31. The pump-plate *a b* is pierced at its centre *c* with a hole which branches towards each of the barrels, as represented by *c d*, *c e*. Between the plate and the barrel slides another plate *h i*, pierced in the middle with a branched hole *f d g*, and near the ends with two holes *h h*, *i i*, which go from its under side to the ends. The holes in these two plates are so adjusted, that when the plate *h i* is drawn so far towards *h* that the hole *i* comes within the barrel *m*, the branch *df* of the hole in the middle plate coincides with the branch *cd* of the upper plate, and the holes *e*, *g* are shut. Thus a communication is established between the barrel *l* and the receiver on the pump-plate, and between the barrel *m* and the external air. In this situation the barrel *l* will exhaust, and *m* will discharge. When the piston of *l* is at its mouth, and that of *m* touches its bottom, the sliding plate is shifted over to the other side, so that *m* communicates with the receiver through the passage *g d*, *e c*, and *l* communicates with the air by the passages *h h*.

It is evident that this sliding plate performs the office of four cocks in a very beautiful and simple manner, and that if the pistons apply close to the ends of the barrels, so as to expel the whole air, the pump will be perfect. It works, indeed, against the whole pressure of the external air. But this may be avoided by putting valves on the holes *h*, *i*; and these can do no harm, because the air remaining in them never gets back into the barrel till the piston be at the farther end, and the exhaustion of that stroke completed. But the best workmen of London think that it will be incomparably more difficult to execute this cock (for it is a cock of an unusual form), in such a manner that it shall be air-tight and yet move with tolerable ease, and that it is much more liable to wearing loose than common cocks. No accurate accounts have been received of its performance. It must be acknowledged to be ingenious, and it may suggest to an intelligent artist a method of combining common conical cocks upon one axis so as to answer the same purposes much more effectually; for which reason we have inserted it here.

156 and by Cuthbertson.

The last improvement which we shall mention is that published by Mr Cuthbertson, philosophical instrument-maker in Amsterdam, now of London. His pump has given such evidences of its perfection, that we can hardly expect or wish for any thing more complete. But we must be allowed to observe, beforehand, that the same construction was invented, and, in part, executed before the end of 1779, by Dr Daniel Rutherford, now professor of botany in the university of Edinburgh, who was at that time engaged in experiments on the production of air during the combustion of bodies in contact with nitre, and who was vastly desirous of procuring a more complete abstraction of pure aerial matter than could be effected by Mr Smeaton's pump. The compiler of this article had then an opportunity of perusing the Doctor's dissertation on this subject, which was read in the Philosophical Society of Edinburgh. In this dissertation the Doctor appears fully apprised of the existence of pure vital air in the nitrous acid, as its chief ingredient, and as the cause of its most remarkable phenomena, and to want but a step to the discoveries which have ennobled the name of Mr Lavoisier. He was particularly anxious to obtain *apart* this distinguishing ingredient in its composition, and, for this purpose, to abstract completely from the vessel in which he subjected it to examination every particle of elastic matter. The writer of this article proposed to him to cover the bottom of Mr Smeaton's piston with some clammy matter, which should take hold of the bottom valve, and *start it* when the piston was drawn up. A few days after, the Doctor showed him a drawing of a pump, having a conical metal valve in the bottom, furnished with a long slender wire, sliding in the inside of the piston-rod with a gentle friction, sufficient for lifting the valve, and secured against all chance of failure by a spring a-top, which took hold of a notch in the inside of the piston-rod about a quarter of an inch from the lower end, so as certainly to lift the valve during the last quarter of an inch of the piston's motion. Being an excellent mechanic, he had executed a valve on this principle, and was fully satisfied with its performance. But having already confirmed his doctrines respecting the nitrous acid by incontrovertible experiments, his wishes to improve the air-pump lost their incitement, and he thought no more of it; and not long after this, the ardour of the philosophers of the Teylerian Society at Haerlem and Amsterdam excited the efforts of Mr Cuthbertson, their instrument-maker, to the same purpose, and produced the most perfect air-pump that has yet appeared. We shall give a description of it, and an account of its performance, in the inventor's own words.

Cuthbertson's Air-pump.

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On Plate CCCCXXVII. fig. 32. is a perspective view Fig. 32. of this pump, with its two principal gages screwed into their places. These need not be used together, except in cases where the utmost exactness is required. In common experiments one of them is removed, and a stop-screw put in its place. When the pear-gage is used, a small round plate, on which the receiver may stand, must be first screwed into the hole at A; but this hole is stopped on other occasions with a screw. When all the three gages are used, and the receiver is exhausted, the stop-screw B, at the bottom of the pump, must be unscrewed, to admit the air into the receiver; but when they are not all used, either of the other stop-screws will answer this purpose.

Fig. 33. represents a cross-bar for preventing the barrels from being shaken by working the pump or by any accident. Its place in fig. 32. is represented by the dotted lines. It is confined in its place, and kept close down on the barrels, by two slips of wood NN, which must be drawn out, as well as the screws OO, when the pump is to be taken asunder. Fig. 33.

Plate CCCCXXVIII. exhibits a section of all the working parts of the pump, except the wheel and rack, in which there is nothing uncommon.

Fig. 34. is a section of one of the barrels, with all its internal parts; and figs. 35. 36. 37. and 38. are different parts of the piston, proportioned to the size of the barrel (A) and to one another.

In fig. 34. CD represents the barrel, F the collar of Fig. 34. leathers, G a hollow cylindrical vessel to contain oil, R is also an oil-vessel to receive the oil which is drawn, along with the air, through the hole *aa*, when the piston is drawn upwards; and, when this is full, the oil is carried over with the air, along the tube T, into the oil-vessel G. *cc* is a wire which is driven upwards from the

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(A) The piston and barrel are 1.65 inches in diameter, in proportion to which the scale is drawn. Figures 35. 36. 37. and 38. are, however, of double size.

the hole *a a* by the passage of the air; and as soon as this has escaped, it falls down again by its own weight, shuts up the hole, and prevents all return of the air into the barrel. At *d d* are fixed two pieces of brass, to keep the wire *c c* in a vertical direction, that it may accurately shut the hole. H is a cylindrical wire or rod which carries the piston I, and is made hollow to receive a long wire *g g*, which opens and shuts the hole L; and on the other end of the wire O is screwed a nut, which, by stopping in the narrowest part of the hole, prevents the wire from being driven up too far. This wire and screw are more clearly seen in fig. 35. and 39.; they slide in a collar of leather *r r*, fig. 35. and 38. in the middle piece of the piston. Fig. 37. and 38. are the two mean parts which compose the piston, and, when the pieces 36. and 39. are added to it, the whole is represented by fig. 35. Fig. 38. is a piece of brass of a conical form, with a shoulder at the bottom. A long hollow screw is cut in it, about two-thirds of its length, and the remainder of the hole, in which there is no screw, is of about the same diameter with the screwed part, except a thin plate at the end, which is of a width exactly equal to the thickness of *g g*. That part of the inside of the conical brass in which no thread is cut, is filled with oiled leathers with holes through which *g g* can slide stiffly. There is also a male screw with a hole in it, fitted to *g g*, serving to compress the leathers *r r*. In fig. 37. *a a a a* is the outside of the piston, the inside of which is turned so as exactly to fit the outside of fig. 38. *b b* are round leathers about 60 in number, *c c* is a circular piece of brass of the size of the leathers, and *d d* is a screw serving to compress them. The screw at the end of fig. 36. is made to fit the screw in fig. 38. Now if fig. 39. be pushed into fig. 38. this into fig. 37. and fig. 36. be screwed into the end of fig. 38. these will compose the whole of the piston, as represented in fig. 34. H in fig. 34. represents the same part as H in fig. 35. and is that to which the rack is fixed. If, therefore, this be drawn upwards, it will cause fig. 38. to shut close into fig. 37. and drive out the air above it; and when it is pushed downward, it will open as far as the shoulder *a a* will permit, and suffer air to pass

Fig. 40. through. AA, fig. 40. is the receiver plate, BB is a long square piece of brass, screwed into the under side of the plate, through which a hole is drilled corresponding to that in the centre of the receiver-plates and with three female screws *b*, *b*, *c*.

The rarefaction of the air in the receiver is affected as follows. Suppose the piston at the bottom of the barrel. The inside of the barrel, from the top of the piston to *a*,

Fig. 34. fig. 34. contains common air. When the rod is drawn up, the upper part of the piston sticks fast in the barrel till the conical part connected with the rod shuts the conical hole, and its shoulder applies close to its bottom. The piston is now shut, and therefore the *whole* is drawn up by the rack-work, driving the air before it through the hole *a c*, into the oil vessel at R, and out into the room by the tube T. The piston will then be at the top of the barrel at *a*, and the wire *g g* will stand nearly as represented in the figure just raised from the hole L, and prevented from rising higher by the nut Q. During this motion the air will expand in the receiver, and come along the bent tube *m* into the barrel. Thus the barrel will be filled with air, which, as the piston rises, will be rarefied in proportion as the capacity of the receiver pipes, and barrel, is to the barrel alone. When the piston is moved down again by the rack-work, it will force the conical part fig. 38. out of the hollow part fig. 37. as far as the shoulders *a a*; fig. 35. will rest on *a a* fig. 37. which will then be so far open as to permit the air to pass freely through it, while at the same time the end of *g g* is forced against the top of the hole, and shuts it in order to prevent any air from returning into the receiver. Thus the piston, moving downwards, suffers the air to pass out between the sides of fig. 37. and 38.; and, when it is at the bottom of the barrel, will have the column of air above it; and, consequently, when drawn upwards it will shut, and drive out this air, and, by opening the hole L at the same time, will give a free passage to more air from the receiver. This process being continued, the air of the receiver will be rarefied *as far as its expansive power will permit*. For in this machine there are no valves to be forced open by the elasticity of the air in the receiver, which at last it is unable to effect. There is therefore nothing to prevent the air from expanding to its utmost degree.

It may be suspected here, that as the air must escape through the discharging passage *a c*, fig. 34. against the pressure of a column of oil and the weight of the wire, there will remain in this passage a quantity of air of considerable density, which will expand again into the barrel during the descent of the piston, and thus put a stop to the progress of rarefaction. This is the case in Mr Smeaton's pump, and all which have valves in the piston. But it is the peculiar excellency of this pump, that whatever be the density of the air remaining in *a c*, the rarefaction will still go on. It is worth while to be perfectly convinced of this. Let us suppose that the air contained in *a c* is $\frac{1}{100}$th part of the common air which would fill the barrel, and that the capacity of the barrel is equal to that of the receiver and passages, and that the air in the receiver and barrel is of the same density, the piston being at the bottom of the barrel: The barrel will therefore contain $\frac{10}{1000}$ parts of its natural quantity, and the receiver $\frac{10}{1000}$. Now let the piston be drawn up. No air will be discharged at *a c*, because it will contain the whole air which was in the barrel, and which has now collapsed into its ordinary bulk. But this does not in the least hinder the air of the receiver from expanding into the barrel, and diffusing itself equally between both. Each will now contain $\frac{5}{1000}$ of their ordinary quantity when the piston is at the top, and *a c* will contain $\frac{1}{100}$ as before, or $\frac{10}{1000}$. Now push down the piston. The hole L is instantly shut, and the air in *a c* expands into the barrel, and the barrel now contains $\frac{15}{1000}$. When the piston has reached the bottom, let it be again drawn up. There will be $\frac{5}{1000}$ discharged through *c*, and the air in the receiver will again be equally distributed between it and the barrel. Therefore the receiver will now contain $\frac{2\frac{1}{2}}{1000}$. When the piston reaches the bottom, there will be $\frac{12\frac{1}{2}}{1000}$ in the barrel. When again drawn up to the top, there will be $\frac{2\frac{1}{2}}{1000}$ discharged, and the receiver will contain $\frac{1\frac{1}{4}}{1000}$; and when the piston reaches the bottom, there will be $\frac{11\frac{1}{4}}{1000}$. At the next stroke the receiver will contain only $\frac{0.\frac{5}{8}}{1000}$, &c. &c.

Thus it appears, that notwithstanding the $\frac{10}{1000}$ which always expands back again out of the hole *a c* into the barrel, the rarity of the air in the receiver will be doubled at every stroke. There is therefore no need of a subsidiary air-pump at *c*, as in the American air-pump, and in the Swedish attempt to improve Smeaton's.

In using this air-pump no particular directions are necessary, nor is any peculiar care necessary for keeping it in order, except that the oil-vessel A be always kept about half full of oil. When the pump has stood long without being used, it will be proper to draw a table-spoonful of olive-oil through it, by pouring it into the hole in the middle of the receiver-plate when the piston is at the bottom of the barrel. Then by working the piston, the oil will be drawn through all the parts of the pump, and the surplus will be driven through the tube T into the oil-vessel G. Near the top of the piston-rod at H there is a hole which lets some oil into the inside of the rod, which gets at the collar of leathers *r r*, and keeps the wire *g g* air-tight.

Fig 41.

When the pump is used for condensation at the same time that it rarefies, or separately, the piece containing the bent tube T must be removed, and fig. 41. put into its place, and fixed by its screws. Fig. 41. as drawn in the plate, is intended for a double-barrelled pump. But for a single barrel only one piece is used, represented by *b a a*, the double piece being cut off at the dotted line *a a*. In this piece is a female screw to receive the end of a long brass tube, to which a bladder (if sufficient for the experiment of condensation), or a glass, properly secured for this purpose, must be screwed. Then the air which is abstracted from the receiver on the pump-plate will be forced into the bladder or glass. But if the pump be double, the apparatus fig. 41. is used, and the long brass tube screwed on at *c*.

Fig. 42. and 43.

Fig. 42. and 43. represent the two gages, which will be sufficiently explained afterwards. Fig. 42. is screwed into *c b*, or into the screw at the other end of *c*, fig. 40. and fig. 43. into the screw *a b*, fig. 40.

If it be used as a single pump, either to rarefy or condense, the screw K, which fastens the rack to the piston-rod H, must be taken out. Then turning the winch till H is depressed as low as possible, the machine will be fitted to exhaust as a single pump; and if it be required to condense, the direction in N° 8. must be observed with regard to the tube T, and fig. 41.

"I took (says Mr Cuthbertson) two barometer-tubes of an equal bore with that fixed to the pump. These were filled with mercury four times boiled. They were then compared, and stood exactly at the same height. The mercury in one of them was boiled in it four times more, without making any change in their height; they were therefore judged very perfect. One of these was immersed in the cistern of the pump-gage, and fastened in a position parallel to it, and a sliding scale of one inch was attached to it. This scale, when the gage is used, must have its upper edge set equal with the surface of the mercury in the boiled tube after exhaustion, and the difference between the height of the mercury in this and in the other barometer tube may be observed to the $\frac{1}{100}$ of an inch; and being close together, no error arises from their not being exactly vertical, if they are only parallel. This gage will be better understood by inspecting fig. 43.

"I used a second gage, which I shall call a double syphon. See fig. 42. This was also prepared with the utmost care. I had a scale for measuring the difference between the height of the columns in the two legs. It was an inch long, and divided as the former, and kept in a truly vertical position by suspending it from a point with a weight hung to it, as represented in the figure. Upon comparing these two gages, I always found them to indicate the same degree of rarefaction. I also used a pear-gage, though the most imperfect of all, in order to repeat the curious experiments of Mr Nairne and others."

When experiments require the utmost rarefying power of the pump, the receiver must not be placed on leather, either oiled or soaked in water, as is usually done. The pump plate and the edge of the receiver must be ground very flat and true, and this with very fine emery, that no roughness may remain. The plate of the pump must then be wiped very clean and very dry, and the receiver rubbed with a warm cloth till it become electrical. The receiver being now set on the plate, hog's lard, either alone or mixed with a little oil, which has been cleared of water by boiling, must be smeared round its outside edge. In this condition the pump will rarefy its utmost, and what still remains in the receiver will be permanent air. Or a little of this composition may be thinly smeared on the pump-plate; this will prevent all risk of scratching it with the edge of the receiver. Leather of very uniform thickness, long dried before a fire, and well soaked in this composition, which must be cleared of all water by the first boiling, will answer very well, and is expeditious, when receivers are to be frequently shifted. Other leathers should be at hand soaked in a composition containing a little rosin. This gives it a clamminess which renders it impermeable to air, and is very proper at all joints of the pump, and all apparatus for pneumatic experiments. As it is impossible to render the pear-gage as dry as other parts of the apparatus, there will be generally some variation between this and the other gages.

When it is only intended to show the utmost power of the pump, without intending to ascertain the quality of the residuum, the receiver may be set on wet leather. If, in this condition, the air be rarefied as far as possible, the syphon and barometer gage will indicate a less degree of rarefaction than in the former experiments. But when the air is let in again, the pear-gage will point out a rarefaction some thousands of times greater than it did before. If the true quality of permanent air after exhaustion be required, the pear-gage will be nearest the truth: for when the air is rarefied to a certain degree, the moistened leather emits an expansible fluid, which, filling the receiver, forces out the permanent air; and the two first gages indicate a degree of exhaustion which relates to the whole elastic matter remaining in the receiver, viz. to the expansible fluid together with the permanent air; whereas the pear-gage points out the degree of exhaustion, with relation to the permanent air alone, which remains in the receiver; for by the pressure of the air admitted into the receiver, the elastic vapour is reduced to its former bulk, which is imperceptible.

Many bodies emit this elastic fluid when the pressure of the air is much diminished; a piece of leather, in its ordinary damp state, about an inch square, or a bit of green or dry wood, will supply this for a great while.

When such fluids have been generated in any experiments, the pump must be carefully cleared of them, for they remain not only in the receiver, but in the barrels and passages, and will again expand when the exhaustion has been carried far.

The best method of clearing the pump is to take a very large receiver, and, using every precaution to exhaust it as far as possible. Then the expansible matter lurking in the barrels and passes will be diffused through the receiver also, or will be carried off along with its air. It will be as much rarer than it was before, as the aggregate capacity of the receiver barrels and passes is larger than that of the two last.

The performance of the pump may be judged of from the four following experiments.

The two gages being screwed into their places, and the hole in the receiver-plate shut up, the pump was made to exhaust as far as it could. The mercury in the legs of the syphon was only $\frac{1}{40}$ of an inch out of the level, and that in the boiled barometer-tube $\frac{1}{40}$ of an inch higher than in the one screwed to the pump. A standard barometer then stood at 30 inches, and therefore the pump rarefied the permanent air 1200 times. This is twice as much as Mr Nairne found Mr Smeaton's do in its best state. Mr Cavallo seems disposed to give a favourable (while we must suppose it a just) account of Haas and Hurter's pump, and it appears never to have exceeded 600 times. Mr Cuthbertson has often found the mercury within $\frac{1}{100}$ of an inch of the level in the syphon-gage, indicating a rarefaction of 3000.

To the end of a glass tube, 2 inches diameter and 30 inches long, was fitted a brass cap and collar of leather, through which a wire was inserted, reaching about two inches within the tube. This was connected with the conductor of an electric machine. The other end was ground flat and set on the pump plate. When the gages indicated a rarefaction of 3000, the light became steady and uniform, of a pale colour, though a little tinged with purple; at 600 the light was of a pale dusky white; when 1200 it disappeared in the middle of the tube, and the tube conducted so well that the prime conductor only gave sparks so faint and short as to be scarcely perceptible. After taking off the tube, and making it as dry as possible, it was again connected with the conductor, which was giving sparks two inches long. When the air in it was rarefied ten times, the sparks were of the same length. Sometimes a pencil of light darted along the tube. When the rarefaction was 20, the spark did not exceed an inch, and light streamed the whole length of the tube. When the rarefaction was 30, the sparks were half an inch, and the light rushed along the tube in great streams. When the rarefaction was 100, the sparks were about $\frac{1}{8}$ long, and the light filled the tube in an uninterrupted body. When 300, the appearances were as before. When 600, the sparks were $\frac{1}{10}$, and the light was of a faint white colour in the middle, but tinged with purple towards the ends. When 1200, the light was hardly perceptible in the middle, and was much fainter at the ends than before, but still ruddy. When 1400, which was the most the pump could produce, six inches of the middle of the tube were quite dark, and the ends free of any tinge of red, and the sparks did not exceed $\frac{1}{40}$ of an inch.

158 The best improvements of the air-pump have been made in Britain.

WE trust that our readers will not be displeased with the preceding history of the air-pump. The occasional information which it gives will be of great use to every person much engaged in pneumatic experiments, and help him in the contrivance and construction of the necessary apparatus.

We may be indulged in one remark, that although this noble instrument originated in Germany, all its improvements were made in this kingdom. Both the mechanical and pneumatical principles of Mr Boyle's construction were extremely different from the German, and, in respect of expedition and conveniency, much superior. The double barrel and gage by Hawkesbee were capital improvements, and on principle; and Mr Smeaton's method of making the piston work in rarefied air made a complete change in the whole process.

159 Utility of the air-pump.

Aided by this machine, we can make experiments establishing and illustrating the gravity and elasticity of the air, in a much more perspicuous manner than could be done by the spontaneous phenomena of nature.

160 Experiments to show this utility.

It allows us in the first place to show the materiality of air in a very distinct manner. Bodies cannot move about in the atmosphere without displacing it. This requires force; and the resistance of the air always diminishes the velocity of bodies moving in it. A heavy body therefore has the velocity of its fall diminished; and if the quantity of air displaced be very great, the diminution will be very considerable. This is the reason why light bodies, such as feathers, fall very slowly. Their moving force is very small, and can therefore displace a great quantity of air only with a very small velocity. But if the same body be dropped *in vacuo*, when there is no air to be displaced, it falls with the whole velocity competent to its gravity. Fig. 44. represents an apparatus by which a guinea and a downy feather are dropped at the same instant, by opening the forceps which holds them by means of the slip-wire in the top of the receiver. If this be done after the air has been pumped out, the guinea and the feather will be observed to reach the bottom at the same instant.

Plate CCCCXXIX. fig. 44.

161 Fig. 45.

Fig. 45. represents another apparatus for showing the same thing. It consists of two sets of brass vanes put in separate axles, in the manner of windmill sails. One set has their edges placed in the direction of their whirling motion, that is, in a plane to which the axis is perpendicular. The planes of the other set pass through the axis, and they are therefore trimmed so as directly to front the air through which they move. Two springs act upon pins projecting from the axis; and their strength or tensions are so adjusted, that when they are disengaged *in vacuo*, the two sets continue in motion equally long. If they are disengaged in the air, the vanes which beat the air with their planes will stop long before those which cut it edgewise.

162

We can now abstract the air most completely from a dry vessel, so as to know the precise weight of the air which filled it. The first experiment we have of this kind, done with accuracy, is that of Dr Hooke, February 10. 1664, when he found 114 pints of air to weigh 945 grains. One pint of water was $8\frac{7}{58}$ ounces. This gives for the specific gravity of air $\frac{1}{850}$ very nearly.

163 **The effect of air on the weight of bodies immersed in it.**

Since we are thus immersed in a gravitating fluid, it follows, that every body preponderates only with the excess of its own weight above that of the air which it displaces; for every body loses by this immersion the weight of the displaced air. A cubic foot loses about 521 grains in frosty weather. We see balloons even rise in the air, as a piece of cork rises in water. A mass of water which really contains 850 pounds will load the scale of a balance with 849 only, and will be balanced by about $849\frac{1}{8}$ pounds of brass. This is evinced by a very pretty experiment, represented in fig. 46. A small beam is suspended within a receiver. To one end of the beam is appended a thin glass or copper ball, close in every part. This is balanced by a small piece of lead hung on the other arm. As the air is pumped out of the receiver, the ball will gradually preponderate, and will regain its equilibrium when the air is re-admitted. **Fig. 46.**

164 Some naturalists have proposed, and actually used, a large globe of light make, suspended at a beam, for a barometer. If its capacity be a cubic foot, $1\frac{7}{10}$ grains will indicate the same change that is indicated by $\frac{1}{10}$ of an inch of an ordinary barometer. But a vessel of this size will load a balance too much to leave it sufficiently sensible to small changes of density. Besides, it is affected by heat and cold, and would require a very troublesome equation to correct their effects.

165 It may perhaps be worth while to attend to this in buying and selling precious commodities; such as pearls, diamonds, silk, and some drugs. As they are generally sold by brass or leaden weights, the buyer will have some advantage when the air is heavy and the barometer high. On the other hand, he will have the advantage in buying gold and mercury when the air is light. It is needless to confine this observation to precious commodities, for the advantage is the same in all in proportion to their levity.

166 There is a case in which this observation is of consequence to the philosopher: we mean the measuring of time by pendulums. As the accelerating force on a pendulum is not its whole weight, but the excess of its weight over that of the displaced air, it follows that a pendulum will vibrate more slowly in the air than *in vacuo*. A pendulum composed of lead, iron, and brass, may be about 8400 times heavier than the air which it displaces when the barometer is at 30 inches and the thermometer at 32°, and the accelerating force will be diminished about $\frac{1}{16800}$. This will cause a second pendulum to make about five vibrations less in a day than it would do *in vacuo*. In order therefore to deduce the accelerative power of gravity from the length of a pendulum vibrating in the air, we must make an allowance of 0″.17, or $\frac{17}{100}$ of a second, per day for every inch that the barometer stands lower than 30 inches. But we must also note the temperature of the air; because when the air is warm it is less dense when supporting by its elasticity the same weight of atmosphere, and we must know how much its density is diminished by an increase of temperature. The correction is still more complicated; for the change of density affects the resistance of the air, and this affects the time of the vibration, and this by a law that is not yet well ascertained. As far as we can determine from any experiments that have been made, it appears that the change arising from the altered resistance takes off about $\frac{2}{5}$ of the change produced by the altered density, and that a second pendulum makes but three vibrations a-day more *in vacuo* than in the open air. This is a very unexpected result; but it must be owned that the experiments have neither been numerous nor very nicely made.

The air-pump also allows us to show the effects of the air's pressure in a great number of amusing and instructive phenomena.

167 **Experiments to show the effects of the air's pressure.**

When the air is abstracted from the receiver, it is strongly pressed to the pump-plate by the incumbent atmosphere, and it supports this great pressure in consequence of its circular form. Being equally compressed on all sides, there is no place where it should give way rather than another; but if it be thin, and not very round, which is sometimes the case, it will be crushed to pieces. If we take a square thin phial, and apply an exhausting syringe to its mouth, it will not fail being crushed.

As the operation of pumping is something like sucking, many of these phenomena are in common discourse ascribed to suction, a word much abused; and this abuse misleads the mind exceedingly in its contemplation of natural phenomena. Nothing is more usual than to speak of the suction of a syringe, the suction and draught of a chimney, &c. The following experiment puts the true cause of the strong adhesion of the receiver beyond a doubt.

Place a small receiver or cupping-glass on the pump-plate without covering the central hole, as represented in fig. 47. and cover it with a larger receiver. Exhaust the air from it; then admit it as suddenly as possible. The outer receiver, which after the rarefaction adhered strongly to the plate, is now loose, and the cupping-glass will be found sticking fast to it. While the rarefaction was going on, the air in the small receiver also expanded, escaped from it, and was abstracted by the pump. When the external air was suddenly admitted, it pressed on the small receiver, and forced it down to the plate, and thus shut up all entry. The small receiver must now adhere; and there can be no suction, for the pipe of the pump was on the outside of the cupping-glass. **Fig. 4**

This experiment sometimes does not succeed, because the air sometimes finds a passage under the brim of the cupping-glass. But if the cupping-glass be pressed down by the hand on the greasy leather or plate, every thing will be made smooth, and the glass will be so little raised by the expansion of its air during the pumping, that it will instantly clap close when the air is re-admitted.

168 In like manner, if a thin square phial be furnished with a valve, opening from within, but shutting when pressed from without, and if this phial be put under a receiver, and the air be abstracted from the receiver, the air in the phial will expand during the rarefaction, will escape through the valve, and be at last in a very rarefied state

within the phial. If the air be now admitted into the receiver, it will press on the flat sides of the included phial and crush it to pieces. See fig. 48. Fig. 48.

169 Fig. 49. If a piece of wet ox-bladder be laid over the top of a receiver whose orifice is about four inches wide, and the air be exhausted from within it, the incumbent atmosphere will press down the bladder into a hollow form, and then burst it inward with a prodigious noise. See fig. 49. Or if a piece of thin flat glass be laid over the receiver, with an oiled leather between them to make the juncture air-tight, the glass will be broken downwards. This must be done with caution, because the pieces of glass sometimes fly about with great force.

170 Fig. 50. If there be formed two hemispherical cups of brass, with very flat thick brims, and one of them be fitted with a neck and stopcock, as represented by fig. 50. the air may be abstracted from them by screwing the neck into the hole in the pump-plate. To prevent the insinuation of air, a ring of oiled leather may be put between the rims. Now unscrew the sphere from the pump, and fix hooks to each, and suspend them from a strong nail, and hang a scale to the lowest. It will require a considerable weight to separate them; namely, about 15 pounds for every square inch of the great circle of the sphere. If this be four inches diameter, it will require near 190 pounds. This pretty experiment was first made by Otto Guericke, and on a very great scale. His sphere was of a large size, and when exhausted the hemispheres could not be drawn asunder by 20 horses. It was exhibited, along with many others equally curious and magnificent, to the emperor of Germany and his court, at the breaking up of the diet of Ratisbon in 1654.

171 Fig. 51. If the loaded syringe mentioned in N° 16. be suspended by its piston from the hook in the top plate of the receiver, as in fig. 51. and the air be abstracted by the pump, the syringe will gradually descend (because the elasticity of the air, which formerly balanced the pressure of the atmosphere, is now diminished by its expansion, and is therefore no longer able to press the syringe to the piston), and it will at last drop off. If the air be admitted before this happens, the syringe will immediately rise again,

172 Fig. 52. Screw a short brass pipe into the neck of a transporter, N° 107. on which is set a tall receiver, and immerse it into a cistern of water. On opening the cock the pressure of the air on the surface of the water in the cistern will force it up through the pipe, and cause it to spout into the receiver with a strong jet, because there is no air within to balance by its elasticity the pressure of the atmosphere. See fig. 52.

173 By means of this pressure the gage of an air-pump acts. It is in the same way that the gage of the air-pump performs its office. The pressure of the atmosphere raises the mercury in the gage till the weight of the mercury, together with the remaining elasticity of the air in the receiver, are in equilibrio with the whole pressure of the atmosphere: therefore the height and weight of the mercury in the gage is the excess of the weight of the atmosphere above the elasticity of the included air; and the deficiency of this height from that of the mercury in the Toricellian tube is the measure of this remaining elasticity.

174 Fig. 53. If a Toricellian tube be put under a tall receiver, as shown in fig. 53. and the air be exhausted, the mercury in the tube will descend while that in the gage will rise; and the sum of their heights will always be the same, that is, equal to the height in an ordinary barometer. The height of the mercury in the receiver is the effect and measure of the remaining elasticity of the included air, and the height in the pump-gage is the unbalanced pressure of the atmosphere. This is a very instructive experiment, perfectly similar to Mr Auzout's, mentioned in N° 34. and completely establishes and illustrates the whole doctrine of atmospheric pressure.

175 Water rises in pumps, Fig. 54. We get a similar illustration and confirmation (if such a thing be now needed) of the cause of the rise of water in pumps, by screwing a syringe into the top plate of a receiver, which syringe has a short glass-pipe plunging into a small cup of water. See fig. 54. When the piston-rod is drawn up, the water rises in the glass-pipe, as in any other pump, of which this is a miniature representation. But if the air has been previously exhausted from the receiver, there is nothing to press on the water in the little jar; and it will not rise in the glass pipe though the piston of the syringe be drawn to the top.

176 and moves in syphons. Fig. 55. Analogous to the rise of water in pumps is its rise and motion in syphons. Suppose a pipe ABCD, fig. 55. bent at right angles at B and C, and having its two ends immersed in the cisterns of water A and D. Let the leg CD be longer than the leg BA, and let the whole be full of water. The water is pressed upwards at A with a force equal to the weight of the column of air E A reaching to the top of the atmosphere; but it is pressed downwards by the weight of the column of water B A. The water at E is pressed downwards by the weight of the column CD, and upwards by the weight of the column of air FD reaching to the top of the atmosphere. The two columns of air differ very little in their weight, and may without any sensible error be considered as equal. Therefore there is a superiority of pressure downwards at D, and the water will flow out there. The pressure of the air will raise the water in the leg AB, and thus the stream will be kept up till the vessel A is emptied as low as the orifice of the leg BA, provided the height of AB is not greater than what the pressure of the atmosphere can balance, that is, does not exceed 32 or 33 feet for water, 30 inches for mercury, &c.

A syphon then will always run from that vessel whose surface is highest; the form of the pipe is indifferent, because the hydrostatical pressures depend on the vertical height only. It must be filled with water by some other contrivance, such as a funnel, or a pump applied a-top; and the funnel must be stopped up, otherwise the air would get in, and the water would fall in both legs.

177 Fig. 56. If the syphon have equal legs, as in fig. 56. and be turned up at the ends, it will remain full of water, and be ready for use. It need only be dipped into any vessel of water, and the water will then flow out at the other end of the syphon. This is called the *Wirtemberg syphon*, and is represented in fig. 56. Syphons will afterwards be considered more minutely under the title of *Pneumatical Engines*, at the end of this article.

178 The syphon fountain. Fig. 57. What is called the *syphon fountain*, constructed on this principle, is shown in fig. 57. where AB is a tall receiver, standing in a wide bason DE, which is supported on the pedestal H by the hollow pillar FG. In the centre of the receiver is a jet pipe C, and in the top a ground stopper A. Near the base of the pillar is a cock N, and in the pedestal is another cock O.

Fill the bason DE with water within half an inch of the brim. Then pour in water at the top of the receiver (the cock N being shut) till it is about half full, and then put in the stopper. A little water will run out into the vessel DE. But before it runs over, open the cock N, and the water will run into the cistern H; and by the time that the pipe C appears above water, a jet will rise from it, and continue as long as water is supplied from the bason DE. The passage into the base cistern may be so tempered by the cock N that the water within the receiver shall keep at the same height, and what runs into the base may be received from the cock O into another vessel, and returned into DE, to keep up the stream.

179
Manner of its construction and operation.
Fig. 58.

This pretty philosophical toy may be constructed in the following manner. BB, fig. 58. is the ferril or cap into which the receiver is cemented. From its centre descends the jet pipe C *a*, sloping outwards, to give room for the discharging pipe *b d* of larger diameter, whose lower extremity *d* fits tightly into the top of the hollow pillar FG.

Fig. 57.

The operation of the toy is easily understood. Suppose the distance from C to H (fig. 57.) three feet, which is about $\frac{1}{11}$ of the height at which the atmosphere would support a column of water. The water poured into AB would descend through FG (the hole A being shut) till the air has expanded $\frac{1}{10}$, and then it would stop. If the pipe C *a* be now opened, the pressure of the air on the surface of the water in the cistern DE will cause it to spout through C to the height of three feet nearly, and the water will continue to descend through the pipe FG. By tempering the cock N so as to allow the water to pass through it as fast as it is supplied by the jet, the amusement may be continued a long time. It will stop at last, however; because as the jet is made into rarefied air, a little air will be extricated from the water, which will gradually accumulate in the receiver, and diminish its rarefaction, which is the moving cause of the jet. This indeed is an inconvenience felt in every employment of syphons, so much the more remarkably as their top is higher than the surface of the water in the cistern of supply.

180
Syphons are often used thus.
Fig. 59.

Cases of this employment of a syphon are not unfrequent. When water collected at A (fig. 59.) is to be conducted in a pipe to C, situated in a lower part of the country, it sometimes happens, as between Lochend and Leith, that the intervening ground is higher than the fountain-head as at B. A forcing pump is erected at A, and the water forced along the pipe. Once it runs out at C, the pump may be removed, and the water will continue to run on the syphon principle, provided BD do not exceed 33 feet. But the water in that part of the conduit which is above the horizontal plane AD, is in the same state as in a receiver of rarefied air, and gives out some of the air which is chemically united with it. This gradually accumulates in the elevated part of the conduit, and at last chokes it entirely. When this happens, the forcing pump must again be worked. Although the elevation in the Leith conduit is only about eight or ten feet, it will seldom run for 12 hours. N. B. This air cannot be discharged by the usual air-cocks; for if there were an opening at B, the air would rush in, and immediately stop the motion.

181
The air-pump discovers the combination of air with water,

This combination of air with water is very distinctly seen by means of the air-pump. If a small glass containing cold water, fresh drawn from the spring, be exposed, as in fig. 6. under the receiver, and the air rarefied, small bubbles will be observed to form on the inner surface of the glass, or on the surface of any body immersed in it, which will increase in size, and then detach themselves from the glass and reach the top; as the rarefaction advances, the whole water begins to show very minute air-bubbles rising to the top; and this appearance will continue for a very long time, till it be completely disengaged. Warming the water will occasion a still farther separation of air, and a boiling heat will separate all that can be disengaged. The reason assigned for these air-bubbles first appearing on the surface of the glass, &c. is, that air is attracted by bodies, and adheres to their surface. This may be so. But it is more probably owing to the attraction of the water for the glass, which causes it to quit the air which it held in solution, in the same manner as we see it happen when it is mixed with spirits-of-wine, with vitriolic acid, &c. or when salts or sugar are dissolved in it. For if we pour out the water which has been purged of air by boiling *in vacuo*, and fill the glass with fresh water, we shall observe the same thing, although a film of the purified water was left adhering to the glass. In this case there can be no air adhering to the glass.

Plate cccccxx. fig. 6.

182

Water thus purged of air by boiling (or even without boiling) *in vacuo*, will again absorb air when exposed to the atmosphere. The best demonstration of this is to fill with this water a phial, leaving about the size of a pea not filled. Immerse this in a vessel of water, with the mouth undermost, by which means the air-bubble will mount up to the bottom of the phial. After some days standing in this condition, the air-bubble will be completely absorbed, and the vessel quite filled with water.

The air in this state of chemical solution has lost its elasticity, for the water is not more compressible than common water. It is also found that water brought up from a great depth under ground contains much more air than water at the surface. Indeed fountain waters differ exceedingly in this respect. The water which now comes into the city of Edinburgh by pipes contains so much as to throw it into a considerable ebullition *in vacuo*. Other liquors contain much greater quantities of elastic fluids in this loosely combined state. A glass of beer treated in the same way will be almost wholly converted into froth by the escape of its fixed air, and will have lost entirely the prickling smartness which is so agreeable, and become quite vapid.

183
and illustrates the air's elasticity and expansibility.

The air-pump gives us, in the next place, a great variety of experiments illustrative of the air's elasticity and expansibility. The very operation of exhaustion, as it is called, is an instance of its great, and hitherto unlimited, expansibility. But this is not palpably exhibited to view. The following experiments show it most distinctly.

184
Experiments showing these properties.

1st, Put a flaccid bladder, of which the neck is firmly tied with a thread, under a receiver, and work the pump. The bladder will gradually swell, and will even be fully distended. Upon readmitting the air, into the receiver, the bladder gradually collapses again into its former dimensions: while the bladder is flaccid, the air within it is of the same density and elasticity with the surrounding air, and its elasticity balances the pressure of the atmosphere. When part of the air of the receiver is abstracted, the remainder expands so as still to fill the receiver: but by expanding, its elasticity is plainly diminished; for we see by the fact, that the elasticity of the air of the receiver no longer balances the elasticity of that in the bladder, as it no longer keeps it in its dimensions. The air in the bladder expands also: it expands till its diminished elasticity is again in equilibrio with the diminished elasticity of the air in the receiver; that is, till its density is the same. When all the wrinkles of the bladder have disappeared, its air can expand no more, although we continue to diminish the elasticity of the air of the receiver by further rarefaction. The bladder now tends to burst; and if it be pierced by a point or knife fastened to the slip-wire, the air will rush out, and the mercury descend rapidly in the gage.

185 If a phial or tube be partly filled with water, and immersed in a vessel of water with the mouth downwards, the air will occupy the upper part of the phial. If this apparatus be put under a receiver, and the air be abstracted, the air in the phial will gradually expand, allowing the water to run out by its weight till the surface of the water be on a level within and without. When this is the case, we must grant that the density and elasticity of the air in the phial is the same with that in the receiver. When we work the pump again, we shall observe the air in the phial expand still more, and come out of the water in bubbles. Continuing the operation, we shall see the air continually escaping from the phial: when this is over, it shows that the pump can rarefy no more. If we now admit the air into the receiver, we shall see the water rise into the phial, and at last almost completely fill it, leaving only a very small bubble of air at top. This bubble had expanded so as to fill the whole phial. See this represented in fig. 61.

Fig. 61.

186. Every one must have observed a cavity at the big end of an egg between the shell and the white. The white and yolk are contained in a thin membrane or bladder which adheres loosely to the shell, but is detached from it at that part; and this cavity increases by keeping the egg in a dry place. One may form a judgment of its size, and therefore of the freshness of the egg, by touching it with the tongue; for the shell, where it is not in contact with the contents, will presently feel warm, being quickly heated by the tongue, while the rest of the egg will feel cold.

If a hole be made in the opposite end of the egg, and it be set on a little tripod, and put under a receiver, the expansion of the air in the cavity of the egg will force the contents through the hole till the egg be quite emptied: or, if nearly one half of the egg be taken away at the other end, and the white and yolk taken out, and the shell be put under a receiver, and the air abstracted, the air in the cavity of the egg will expand, gradually detaching the membrane from the shell, till it causes it to swell out, and gives the whole the appearance of an entire egg. In like manner shrivelled apples and other fruits will swell in vacuo by the expansion of the air confined in their cavities.

187 If a piece of wood, a twig with green leaves, charcoal, plaster of Paris, &c. be kept under water in vacuo, a prodigious quantity of air will be extracted; and if we readmit the air into the receiver, it will force the water into the pores of the body. In this case the body will not swim in water as it did before, showing that the vegetable fibres are specifically heavier than water. It is found, however, that the air contained in the pith and bark, such as cork, is not all extricated in this way; and that much of it is contained in vesicles which have no outlet: being secreted into them in the process of vegetation, as it is secreted into the air-bladder of fishes, where it is generally found in a pretty compressed state, considerably denser than the surrounding air. The air-bladder of a fish is surrounded by circular and longitudinal muscles, by which the fish can compress the air still further; and, by ceasing to act with them, allow it to swell out again. It is in this manner that the fish can suit its specific gravity to its situation in the water, so as to have no tendency either to rise or sink: but if the fish be put into the receiver of an air-pump, the rarefaction of the air obliges the fish to act more strongly with these contracting muscles, in order to adjust its specific gravity; and if too much air has been abstracted from the receiver, the fish is no longer able to keep its air-bladder in the proper degree of compression. It becomes therefore too buoyant, and comes to the top of the water, and is obliged to struggle with its tail and fins in order to get down; frequently in vain. The air-bladder sometimes bursts, and the fish goes to the bottom, and can no longer keep above without the continual action of its tail and fins. When fishes die, they commonly float at top, their contractive action being now at an end. All this may be illustrated (but very imperfectly) by a small half blown bladder, to which is appended a bit of lead, just so heavy as to make it sink in water: when this is put under a receiver, and the air abstracted, the bubble will rise to the top; and, by nicely adjusting the rarefaction, it may be kept at any height. See fig. 62.

Fig. 62.

188 The playthings called *Cartesian devils* are similar to this: they are hollow glass figures, having a small aperture in the lower part of the figures, as at the point of the foot; their weight is adjusted so that they swim upright in water. When put into a tall jar filled to the top, and having a piece of leather tied over it, they will sink in the water, by pressing on the leather with the ball of the hand: this, by compressing the water, forces some of it to enter into the figure and makes it heavier than the water; for which reason it sinks, but rises again on removing the pressure of the hand. See figs. 63. and 64.

Figs. 63. and 64.

If a half blown ox bladder be put into a box, and great weights laid on it, and the whole be put under a receiver, and the air abstracted; the air will, by expanding, lift up the weight, though above an hundred pounds. See fig. 65.

Fig. 65.

189 Compressibility and expansibility are in no state of the air very dissimilar.

By such experiments the great expansibility of the air is abundantly illustrated, as its compressibility was formerly by means of the condensing syringe. We now see that the two sets of experiments form an uninterrupted chain; and that there is no particular state of the air's density where the compressibility and expansibility are remarkable dissimilar. Air in its ordinary state expands; because its ordinary state is a state of compression by the weight of the atmosphere: and if there were a pit about 33 miles deep, the air at the bottom would probably be as dense as water; and if it were 50 miles deep, it would be as dense as gold, if it did not become a liquid before this depth: nay, if a bottle with its mouth undermost were immersed six miles under water, it would probably be as dense as water; we say probably,

probably, for this depends on the nature of its compressibility; that is, on the relation which subsists between the compression and the force which produces it.

190 Relation between compression and the force producing it.

This is the circumstance of its constitution, which we now proceed to examine; and it is evidently a very important circumstance. We have long ago observed, that the great compressibility and permanent fluidity of air, observed in a vast variety of phenomena, is totally inexplicable, on the supposition that the particles of air are like so many balls of sponge or so many foot-balls. Give to those what compressibility you please, common air could no more be fluid than a mass of clay; it could no more be fluid than a mass of such balls pressed into a box. It can be demonstrated (and indeed hardly needs a demonstration), that before a parcel of such balls, just touching each other, can be squeezed into half their present dimensions, their globular shape will be entirely gone, and each will have become a perfect cube, touching six other cubes with its whole surface; and these cubes will be strongly compressed together, so that motion could never be performed through among them by any solid body without a very great force. Whereas we know that in this state air is just as permeable to every body as the common air that we breathe. There is no way in which we can represent this fluidity to our imagination, but by conceiving air to consist of particles, not only discrete, but distant from each other, and actuated by repulsive forces, or something analogous to them. It is an idle subterfuge, to which some naturalists have recourse, saying, that they are kept asunder by an intervening ether, or elastic fluid of any other name. This is only removing the difficulty a step farther off: for the elasticity of this fluid requires the same explanation; and therefore it is necessary, in obedience to the rules of just reasoning, to begin the inquiry here; that is, to determine from the phenomena what is the analogy between the distances of the particles and the repulsive forces exerted at these distances, proceeding in the same way as in the examination of planetary gravitation. We shall learn the analogy by attending to the analogy between the compressing force and the density.

191 Density explained as applied to air.

For the density depends on the distance between the particles; the nearer they are to each other, the denser is the air. Suppose a square pipe one inch wide and eight inches long, shut at one end, and filled with common air; then suppose a plug so nicely fitted to this pipe that no air can pass by its sides; suppose this piston thrust down to within an inch of the bottom: it is evident that the air which formerly filled the whole pipe now occupies the space of one cubic inch, which contains the same number of particles as were formerly diffused over eight cubic inches.

The condensation would have been the same if the air which fills a cube whose side is two inches had been squeezed into a cube of one inch, for the cube of two inches also contains eight inches. Now, in this case it is evident that the distance between the particles would be reduced to its half in every direction. In like manner, if a cube whose side is three inches, and which therefore contains 27 inches, be squeezed into one inch, the distance of the particles will be one-third of what it was: in general the distance of the particles will be as the cube-root of the space into which they are compressed. If the space be $\frac{1}{8}$, $\frac{1}{27}$, $\frac{1}{64}$, $\frac{1}{125}$, &c. of its former dimensions, the distance of the particles will be $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, &c. Now the term *density*, in its strict sense, expresses the vicinity of the particles; *densi arbores* are trees growing near each other. The measure of this vicinity therefore is the true measure of the density; and when 27 inches of air are compressed into one, we should say that it is three times as dense; but we say, that it is 27 times denser.

192 Farther explanation.

Density is therefore used in a sense different from its strictest acceptation: it expresses the comparative number of equidistant particles contained in the same bulk. This is also abundantly precise, when we compare bodies of the same kind, differing in density only; but we also say, that gold is 19 times denser than water, because the same bulk of it is 19 times heavier. This assertion proceeds on the assumption, or the fact, that every ultimate atom of terrestrial matter is equally heavy: a particle of gold may contain more or fewer atoms of matter than a particle of water. In such a case, therefore, the term density has little or no reference to the vicinity of the particles; and is only a term of comparison of other qualities or accidents.

But when we speak of the respective densities of the same substance in its different states of compression, the word *density* is strictly connected with vicinity of particles, and we may safely take either of the measures. We shall abide by the common acceptation, and call that air eight times as dense which has eight times as many particles in the same bulk, although the particles are only twice as near to each other.

193 The analogy between the compressing force and the distance of the particles, &c.

Thus then we see, that by observing the analogy between the compressing force and the density, we shall discover the analogy between the compressing force and the distance of the particles. Now the force which is necessary for compressing two particles of air to a certain vicinity is a proper measure of the elasticity of the particles corresponding to that vicinity or distance; for it balances it, and forces which balance must be esteemed equal. Elasticity is a distinctive name for that corpuscular force which keeps the particles at that distance: therefore observations made on the analogy between the compressing force and the density of air will give us the law of its corpuscular force, in the same way that observations on the simultaneous deflections of the planets towards the sun give us the law of celestial gravitation.

194

But the sensible compressing forces which we are able to apply is at once exerted on unknown thousands of particles, while it is the law of action of a single particle that we want to discover. We must therefore know the *proportion* of the numbers of particles on which the compressing force is exerted. It is easy to see, that since the distance of the particles is as the cube root of the density inversely, the number of particles in physical contact with the compressing surface must be as the square of this root. Thus when a cube of 8 inches is compressed into one inch, and the particles are twice as near each other as they were before, there must be four times the number of particles in contact with each of the sides of this cubical inch; or, when we have pushed down the square piston of the pipe spoken of above to within an inch of the bottom, there will be four times the number of particles *immediately* contiguous to the piston, and resisting the compression; and in order to obtain the force really exerted on one particle, and the elasticity of that particle, we must divide the whole compressing

Experiments on Air.

pressing force by 4. In like manner, if we have compressed air into $\frac{1}{27}$ of its former bulk, and brought the particles to $\frac{1}{3}$ of their former distance, we must divide the compressing force by 9. In general if d express the density, $\frac{1}{\sqrt[3]{d}}$ will express the distance x of the particles; $\sqrt[3]{d}$, or $d^{\frac{1}{3}}$, will express the vicinity or real density; and $d^{\frac{2}{3}}$ will express the number of particles acting on the compressing surface: and if f express the accumulated external compressing force, $\frac{f}{d^{\frac{2}{3}}}$ will express the force acting on one particle; and therefore the elasticity of that particle corresponding to the distance x.

195 Experiments establishing the law of compression.

WE may now proceed to consider the experiments by which the law of compression is to be established.

The first experiments to this purpose were those made by Mr Boyle, published in 1661 in his *Defensio Doctrinæ de Aeris Elatere contra Linum*, and exhibited before the Royal Society the year before. Mariotte made experiments of the same kind, which were published in 1676 in his *Essai sur la Nature de l'Air* and *Traité des Mouvemens des Eaux*. The most copious experiments are those by Sulzer (*Mem. Berlin.* ix.), those by Fontana (*Opusc. Physico-Math.*), and those by Sir George Shuckburgh and Gen. Roy.

196 Compressibility of air not rarer than the atmosphere at the earth's surface. *Fig. 66.*

In order to examine the compressibility of air that is not rarer than the atmosphere at the surface of the earth, we employ a bent tube or syphon ABCD (fig. 66.), hermetically sealed at A and open at D. The short leg AB must be very accurately divided in the proportion of its solid contents, and fitted with a scale whose units denote equal increments, not of length, but of capacity. There are various ways of doing this; but it requires the most scrupulous attention, and without this the experiments are of no value. In particular, the arched form at A must be noticed. A small quantity of mercury must then be poured into the tube, and passed backwards and forwards till it stands (the tube being held in a vertical position) on a level at B and C. Then we are certain that the included air is of the same density with that of the contiguous atmosphere. Mercury is now poured into the leg DC, which will fill it, suppose to G, and will compress the air into a smaller space AE. Draw the horizontal line EF: the new bulk of the compressed air is evidently AE, measured by the adjacent scale, and the addition made to the compressing force of the atmosphere is the weight of the column GF. Produce GF downwards to H, till FH is equal to the height shown by a Toricellian tube filled with the *same mercury*; then the whole compressing force is HG. This is evidently the measure of the elasticity of the compressed air in AE, for it balances it. Now pour in more mercury, and let it rise to g, compressing the air into Ae. Draw the horizontal line ef, and make fh equal to FH; then Ae will be the new bulk of the compressed air, $\frac{AB}{Ae}$ will be its new density, and hg will be the measure of the new elasticity. This operation may be extended as far as we please, by lengthening the tube CD, and taking care that it be strong enough to resist the great pressure. Great care must be taken to keep the whole in a constant temperature, because the elasticity of air is greatly affected by heat, and the change by any increase of temperature is different according to its density or compression.

Compressibility, &c.

197 Experiments of Boyle, &c. neither nicely made nor extended to very great compressions.

The experiments of Boyle, Mariotte, Amontons, and others, were not extended to very great compressions, the density of the air not having been quadrupled in any of them; nor do they seem to have been made with very great nicety. It may be collected from them in general, that the elasticity of the air is very nearly proportioned to its density; and accordingly this law was almost immediately acquiesced in, and was called the *Boylean law*: it is accordingly assumed by almost all writers on the subject as exact. Of late years, however, there occurred questions in which it was of importance that this point should be more scrupulously settled, and the former experiments were repeated and extended. Sulzer and Fontana have carried them farther than any other. Sulzer compressed air into one-eighth of its former dimensions.

198 Varieties, &c. in these experiments.

Considerable varieties and irregularities are to be observed in these experiments. It is extremely difficult to preserve the temperature of the apparatus, particularly of the leg AB, which is most handled. A great quantity of mercury must be employed; and it does not appear that philosophers have been careful to have it precisely similar to that in the barometer, which gives us the unit of compressing force and of elasticity. The mercury in the barometer should be pure and boiled. If the mercury in the syphon is adulterated with bismuth and tin, which it commonly is to a considerable degree, the compressing force, and consequently the elasticity, will appear greater than the truth. If the barometer has not been nicely fitted, it will be lower than it should be, and the compressing force will appear too great, because the unit is too small; and this error will be most remarkable in the smaller compressions.

199 Heterogeneous nature of the air the greatest source of error.

The greatest source of error and irregularity in the experiments is the very heterogeneous nature of the air itself. Air is a solvent of all fluids, all vapours, and perhaps of many solid bodies. It is highly improbable that the different compounds shall have the same elasticity, or even the same law of elasticity: and it is well known, that air, loaded with water or other volatile bodies, is much more expansible by heat than pure air; nay, it would appear from many experiments, that certain determinate changes both of density and of temperature, cause air to let go the vapours which it holds in solution. Cold causes it to precipitate water, as appears in dew; so does rarefaction, as is seen in the receiver of an air-pump.

200 The air's elasticity does not increase so fast as its density.

In general, it appears that the elasticity of air does not increase quite so fast as its density. This will be best seen by the following tables, calculated from the experiments of Mr Sulzer. The column E in each set of experiments expresses the length of the column GH, the unit being FH, while the column D expresses $\frac{AB}{AE}$.

1st Set.		2d Set.		3d Set.	
D	E	D	E	D	E
1.000	1.000	1.000	1.000	1.000	1.000
1.100	1.093	1.236	1.224	1.091	1.076
1.222	1.211	1.294	1.288	1.200	1.183
1.375	1.284	1.375	1.332	1.333	1.303
1.571	1.559	1.466	1.417	1.500	1.472
1.692	1.669	1.571	1.515	1.714	1.659
1.833	1.796	1.692	1.647		
2.000	1.958	2.000	1.964	2.000	1.900
2.288	2.130				
2.444	2.375	2.444	2.392	2.400	2.241
3.143	2.936	3.143	3.078	3.000	2.793
3.666	3.391	3.666	3.575		
4.000	3.706			4.000	3.631
4.444	4.035	4.444	4.320		
4.888	4.438				
5.500	4.922	5.500	5.096		
5.882	5.522			6.000	5.297
		7.333	6.694		
				8.000	6.835

201 There appears in these experiments sufficient grounds for calling in question the Boylean law; and the writer of this article thought it incumbent on him to repeat them with some precautions, which probably had not been attended to by Mr Sulzer. He was particularly anxious to have the air as free as possible from moisture. For this purpose, having detached the short leg of the syphon, which was 34 inches long, he boiled mercury in it, and filled it with mercury boiling hot. He took a tinplate vessel of sufficient capacity, and put into it a quantity of powdered quicklime just taken from the kiln; and having closed the mouth, he agitated the lime through the air in the vessel, and allowed it to remain there all night. He then emptied the mercury out of the syphon into this vessel, keeping the open end far within it. By this means the short leg of the syphon was filled with very dry air. The other part was now joined, and boiled mercury put into the bend of the syphon; and the experiment was then prosecuted with mercury which had been recently boiled, and was the same with which the barometer had been carefully filled.

202 The results of the experiments are expressed in the following table.

Dry Air.		Moist Air.		Damp Air.	
D	E	D	E	D	E
1.000	1.000	1.000	1.000	1.000	1.000
2.000	1.957	2.000	1.920	2.000	1.909
3.000	2.848	3.000	2.839	3.000	2.845
4.000	3.737	4.000	3.726	4.000	3.718
5.500	4.930	5.500	5.000	5.500	5.104
6.000	5.342	6.000	5.452	6.000	5.463
7.620	6.490	7.620	6.775	7.620	6.812

Here it appears again in the clearest manner that the elasticities do not increase as fast as the densities, and the differences are even greater than in Mr Sulzer's experiments.

203 The second table contains the results of experiments made on very damp air in a warm summer's morning. In these it appears that the elasticities are almost precisely proportional to the densities + a small constant quantity, nearly 0.11, deviating from this rule chiefly between the densities 1 and 1.5, within which limits we have very nearly $D=E^{1.0017}$. As this air is nearer to the constitution of atmospheric air than the former, this rule may be safely followed in cases where atmospheric air is concerned, as in measuring the depths of pits by the barometer.

204 The third table shews the compression and elasticity of air strongly impregnated with the vapours of camphire. Here the Boylean law appears pretty exact, or rather the elasticity seems to increase a little faster than the density.

205 Dr Hooke examined the compression of air by immersing a bottle to great depths in the sea, and weighing the water which got into it without any escape of air. But this method was liable to great uncertainty, on account of the unknown temperature of the sea at great depths.

206 Hitherto we have considered only such air as is not rarer than what we breathe; we must take a very different method for examining the elasticity of rarefied air.

Fig. 67. Mode of examining the elasticity of rarefied air.

Let $g\,h$ (fig. 67.) be a long tube, formed a-top into a cup, and of sufficient diameter to receive another smaller tube $a\,f$, open at first at both ends. Let the outer tube and cup be filled with mercury, which will rise in the inner tube to the same level. Let $a\,f$ now be stopped at a. It contains air of the same density and elasticity with the adjoining atmosphere. Note exactly the space $a\,b$ which it occupies. Draw it up into the position of fig. 68. and let the mercury stand in it at the height $d\,e$, while $c\,e$ is the height of the mercury in the barometer. It is evident that the column $d\,e$ is in equilibrio between the pressure of the atmosphere and the elasticity of the air included in the space $a\,d$. And since the weight of $c\,e$ would be in equilibrio with the whole pressure of the atmosphere, the weight of $c\,d$ is equivalent to the elasticity of the included air. While therefore $c\,e$ is the measure of the elasticity of the surrounding atmosphere, $c\,d$ will be the measure of the elasticity of the included air; and since the air originally occupied the space $a\,b$, and has now expanded into $a\,d$, we have $\frac{a\,b}{a\,d}$ for the measure of its density. N. B. $c\,e$ and $c\,d$ are measured by the *perpendicular heights* of the columns, but $a\,b$ and $a\,d$ must be measured by their *solid capacities*.

Fig. 68.

207 By raising the inner tube still higher, the mercury will also rise higher, and the included air will expand still farther, and we obtain another $c\,d$, and another $\frac{a\,b}{a\,d}$; and in this manner the relation between the density and elasticity of rarefied air may be discovered.

208 An easier method by means of the air-pump. Fig. 69.

This examination may be managed more easily by means of the air-pump. Suppose a tube $a\,e$ (fig. 69.) containing a small quantity of air $a\,b$, set up in a cistern of mercury, which is supported in the tube at the height $c\,b$, *e b*, and let *ec* be the height of the mercury in the barometer. Let this apparatus be set under a tubulated receiver on the pump-plate, and let *g n* be the pump-gage, and *mn* be equal to *ce*.

Then, as has been already shown, *c b* is the measure of the elasticity of the air in *a b*, corresponding to the bulk *ab*. Now let some air be abstracted from the receiver. The elasticity of the remainder will be diminished by its expansion; and therefore the mercury in the tube *ae* will descend to some point *d*. For the same reason, the mercury in the gage will rise to some point *o*, and *m o* will express the elasticity of the air in the receiver. This would support the mercury in the tube *a e* at the height *e r*, if the space *a r* were entirely void of air. Therefore *r d* is the effect and measure of the elasticity of the included air when it has expanded to the bulk *ad;* and thus its elasticity, under a variety of other bulks, may be compared with its elasticity when of the bulk *ab*. When the air has been so far abstracted from the receiver that the mercury in *ae* descends to *e*, then *mo* will be the precise measure of its elasticity.

In all these cases it is necessary to compare its bulk *a b* with its natural bulk, in which its elasticity balances the pressure of the atmosphere. This may be done by laying the tube *a e* horizontally, and then the air will collapse into its ordinary bulk.

209
Another easy method.
Fig. 70.

Another easy method may be taken for this examination. Let an apparatus *a b c d e f* (fig. 70.) be made, consisting of a horizontal tube *a e* of even bore, a ball *d g e* of a large diameter, and a swan-neck tube *h f*. Let the ball and part of the tube *g e b* be filled with mercury, so that the tube may be in the same horizontal plane with the surface *d e* of the mercury in the ball. Then seal up the end *a*, and connect *f* with an air-pump. When the air is abstracted from the surface *d e*, the air in *a b* will expand into a larger bulk *a c*, and the mercury in the pump-gage will rise to some distance below the barometric height. It is evident that this distance, without any farther calculation, will be the measure of the elasticity of the air pressing on the surface *de*, and therefore of the air in *ae*.

210
The most exact mode of examining this elasticity.

The most exact of all methods is to suspend in the receiver of an air-pump a glass vessel, having a very narrow mouth, over a cistern of mercury, and then abstract the air till the gage rises to some determined height. The difference *e* between this height and the barometric height determines the elasticity of the air in the receiver and in the suspended vessel. Now lower down that vessel by the slip-wire till its mouth is immersed into the mercury, and admit the air into the receiver; it will press the mercury into the little vessel. Lower it still farther down, till the mercury within it is level with that without; then stop its mouth, take it out and weigh the mercury, and let its weight be *w*. Subtract this weight from the weight *v* of the mercury, which would completely fill the whole vessel; then the natural bulk of the air will be *v*—*w*, while its bulk, when of the elasticity *e* in the rarefied receiver, was the bulk or capacity *w* of the vessel. Its density therefore, corresponding to this elasticity *e*, was $\frac{v-w}{w}$. And thus may the relation between the density and elasticity in all cases be obtained.

A great variety of experiments to this purpose have been made, with different degrees of attention, according to the interest which the philosophers had in the result. Those made by M. de Luc, General Roy, Mr Trembley, and Sir George Shuckburgh, are by far the most accurate; but they are all confined to very moderate rarefactions. The general result has been, that the elasticity of rarefied air is very nearly proportional to its density. We cannot say with confidence that any regular deviation from this law has been observed, there being as many observations on one side as on the other; but we think that it is not unworthy the attention of philosophers to determine it with precision in the cases of extreme rarefaction, where the irregularities are most remarkable. The great source of error is a certain adhesive sluggishness of the mercury when the impelling forces are very small; and other fluids can hardly be used, because they either smear the inside of the tube and diminish its capacity, or they are converted into vapour, which alters the law of elasticity.

211
Various experiments have been made to this purpose.

212
The Boylean law may in general be assumed.

Let us, upon the whole, assume the Boylean law, *viz.* that the elasticity of the air is proportional to its density. The law deviates not in any sensible degree from the truth in those cases which are of the greatest practical importance, that is, when the density does not much exceed or fall short of that of ordinary air.

213
Investigation of the action of the particles on each other.

Let us now see what information this gives us with respect to the action of the particles on each other.

The investigation is extremely easy. We have seen that a force eight times greater than the pressure of the atmosphere will compress common air into the eighth part of its common bulk, and give it eight times its common density: and in this case we know, that the particles are at half their former distance, and that the number which are now acting on the surface of the piston employed to compress them is quadruple of the number which act on it when it is of the common density. Therefore, when this eightfold compressing force is distributed over a fourfold number of particles, the portion of it which acts on each is double. In like manner, when a compressing force 27 is employed, the air is compressed into $\frac{1}{27}$ of its former bulk, the particles are at $\frac{1}{3}$ of their former distance, and the force is distributed among 9 times the number of particles; the force on each is therefore 3. In short, let $\frac{1}{x}$ be the distance of the particles, the number of them in any given vessel, and therefore the density will be as x^3, and the number pressing by their elasticity on its whole internal surface will be as x^2. Experiment shows, that the compressing force is as x^3, which being distributed over the number as x^2, will give the force on each as x. Now this force is in immediato equilibrium with the elasticity of the particle immediately contiguous to the compressing surface. This elasticity is therefore as x: and it follows from the nature of perfect fluidity, that the particle adjoining to the compressing surface presses with an equal force on its adjoining particles on every side. Hence we must conclude, that the corpuscular repulsions exerted by the adjoining particles are inversely as their distances from each other, or that the adjoining particles tend to recede from each other with forces inversely proportional to their distances.

214
Sir Isaac Newton was the first who reasoned properly on this subject.

Sir Isaac Newton was the first who reasoned in this manner from the phenomena. Indeed he was the first who had the patience to reflect on the phenomena with any precision. His discoveries in gravitation naturally gave his thoughts this turn, and he very early hinted his suspicions that all the characteristic phenomena of tangible matter were produced by forces which were exerted by the particles at small and insensible distances: And he considers the phenomena of air as affording an excellent example of this investigation, and deduces from them the law which we have now demonstrated; and says, that air consists of particles which avoid the adjoining particles with forces inversely proportional to their distances from each other. From this he deduces (in the 2d book of his Principles) several beautiful propositions, determining the mechanical constitution of the atmosphere.

215 Limits the action to adjoining particles.

But it must be noticed that he limits this action to the *adjoining* particles: and this is a remark of immense consequence, though not attended to by the numerous experimenters who adopt the law.

It is plain that the particles are supposed to act at a distance, and that this distance is variable, and that the forces diminish as the distances increase. A very ordinary air-pump will rarefy the air 125 times. The distance of the particles is now 5 times greater than before; and yet they still repel each other: for air of this density will still support the mercury in a syphon-gage at the height of 0.24, or $\frac{24}{100}$ of an inch; and a better pump will allow this air to expand twice as much, and still leave it elastic. Thus we see that whatever is the distance of the particles of common air, they can act five times farther off. The question comes now to be, Whether, in the state of common air, they really do act five times farther than the distance of the adjoining particles? While the particle *a* acts on the particle *b* with the force 5, does it also act on the particle *c* with the force 2.5, on the particle *d* with the force 1.667, on the particle *e* with the force 1.25, on the particle *f* with the force 1, on the particle *g* with the force 0.8333, &c.?

216 Sir Isaac Newton shows in the plainest manner, that this is by no means the case; for if this were the case, he makes it appear that the sensible phenomena of condensation would be totally different from what we observe. The force necessary for a quadruple condensation would be eight times greater, and for a nonuple condensation the force must be 27 times greater. Two spheres filled with condensed air must repel each other, and two spheres containing air that is rarer than the surrounding air must attract each other, &c. &c. All this will appear very clearly, by applying to air the reasoning which Sir Isaac Newton has employed in deducing the sensible law of mutual tendency of two spheres, which consist of particles attracting each other with forces proportional to the square of the distance inversely.

217 If we could suppose that the particles of air repelled each other with invariable forces at all distances within some small and insensible limit, this would produce a compressibility and elasticity similar to what we observe. For if we consider a row of particles, within this limit, as compressed by an external force applied to the two extremities, the action of the whole row on the extreme points would be proportional to the number of particles, that is, to their distance inversely and to their density: and a number of such parcels, ranged in a straight line, would constitute a row of any sensible magnitude having the same law of compression. But this law of corpuscular force is unlike every thing we observe in nature, and to the last degree improbable.

Height of the Atmosphere.

218 We must therefore continue the limitation of this mutual repulsion of the particles of air, and be contented for the present with having established it as an experimental fact, that the *adjoining* particles of air are kept asunder by forces inversely proportional to their distances: or perhaps it is better to abide by the sensible law that *the density of air is proportional to the compressing force*. This law is abundantly sufficient for explaining all the subordinate phenomena, and for giving us a complete knowledge of the mechanical constitution of our atmosphere.

219 The height of the air investigated from considering its compressibility, &c.

And in the first place, this view of the compressibility of the air must give us a very different notion of the height of the atmosphere from what we deduced on a former occasion from our experiments. It is found, that when the air is of the temperature 32° of Fahrenheit's thermometer, and the mercury in the barometer stands at 30 inches, it will descend one-tenth of an inch if we take it to a place 87 feet higher. Therefore, if the air were equally dense and heavy throughout, the height of the atmosphere would be $30 \times 10 \times 87$ feet, or 5 miles and 100 yards. But the loose reasoning adduced on that occasion was enough to show us that it must be much higher; because every stratum as we ascend must be successively rarer as it is less compressed by incumbent weight. Not knowing to what degree air expanded when the compression was diminished, we could not tell the successive diminutions of density and consequent augmentation of bulk and height; we could only say, that several atmospheric appearances indicated a much greater height. Clouds have been seen much higher; but the phenomenon of the twilight is the most convincing proof of this. There is no doubt that the visibility of the sky or air is owing to its want of perfect transparency, each particle (whether of matter purely aerial or heterogeneous) reflecting a little light.

220 Fig. 71.

Let *b* (fig. 71.) be the last particle of illuminated air which can be seen in the horizon by a spectator at A. This must be illuminated by a ray SD *b*, touching the earth's surface at some point D. Now it is a known fact, that the degree of illumination called *twilight* is perceived when the sun is 18° below the horizon of the spectator, that is, when the angle E *b* S or ACD is 18 degrees; therefore *b* C is the secant of 9 degrees (it is less, viz. about $8\frac{1}{2}$ degrees, on account of refraction). We know the earth's radius to be about 3970 miles: hence we conclude *b* B to be about 45 miles; nay, a very sensible illumination is perceptible much farther from the sun's place than this, perhaps twice as far, and air is sufficiently dense for reflecting a sensible light at the height of nearly 200 miles.

221 Experiment fixes no limit to the air's expansibility.

We have now seen that air is prodigiously expansible. None of our experiments have distinctly shown us any limit. But it does not follow that it is expansible without end; nor is this at all likely. It is much more probable that there is a certain distance of the parts in which they no longer repel each other; and this would be the distance at which they would arrange themselves if they were not heavy. But at the very summit of the atmosphere they will be a very small matter nearer to each other, on account of their gravitation to the earth.

Till we know precisely the law of this mutual repulsion, we cannot say what is the height of the atmosphere.

222 Farther observations on, and investigation of, the height of the atmosphere.

But if the air be an elastic fluid whose density is always proportionable to the compressing force, we can tell what is its density at any height above the surface of the earth: and we can compare the density so calculated with the density discovered by observation: for this last is measured by the height at which it supports mercury in the barometer. This is the direct measure of the pressure of the external air; and as we know the law of gravitation, we can tell what would be the pressure of air having the calculated density in all its parts.

223 Let us therefore suppose a prismatic or cylindric column of air reaching to the top of the atmosphere. Let this be divided into an indefinite number of strata of very small and equal depths or thickness; and let us, for greater simplicity, suppose at first that a particle of air is of the same weight at all distances from the centre of the earth.

224 The absolute weight of any one of these strata will on these conditions be proportional to the number of particles or the gravity of air contained in it; and since the depth of each stratum is the same, this quantity of air will evidently be as the density of the stratum: but the density of any stratum is as the compressing force; that is, as the pressure of the strata above it; that is, as their weight; that is, as their quantity of matter—therefore the quantity of air in each stratum is proportional to the quantity of air above it; but the quantity in each stratum is the difference between the column incumbent on its bottom and on its top: these differences are therefore proportional to the quantities of which they are the differences. But when there is a series of quantities which are proportional to their own differences, both the quantities and their differences are in continual or geometrical progression: for let *a*, *b*, *c*, be three such quantities that

$b : c = a-b : b-c$, then by alter.

$b : a-b = c : b-c$ and by compos.

$b : a = c : b$

and $a : b = b : c$

therefore the densities of these strata decrease in a geometrical progression; that is, when the elevations above the centre or surface of the earth increase, or their depths under the top of the atmosphere decrease in an arithmetical progression, the densities decrease in a geometrical progression.

225 Fig. 72. Let ARQ (fig. 72.) represent the section of the earth by a plane through its centre O, and let *m* OAM be a vertical line, and AE perpendicular to OA will be a horizontal line through A, a point on the earth's surface. Let AE be taken to represent the density of the air at A; and let DH, parallel to AE, be taken to AE as the density at D is to the density at A: it is evident, that if a logistic or logarithmic curve EHN be drawn, having AN for its axis, and passing through the points E and H, the density of the air at any other point C, in this vertical line, will be represented by CG, the ordinate to the curve in that point: for it is the property of this curve, that if portions AB, AC, AD, of its axis be taken in arithmetical progression, the ordinates, AE, BF, CG, DH, will be in geometrical progression.

226 It is another fundamental property of this curve, that if EK or HS touch the curve in E or H, the subtangent AK or DS is a constant quantity.

227 And a third fundamental property is, that the infinitely extended area MAEN is equal to the rectangle KAEL of the ordinate and subtangent; and, in like manner, the area MDHN is equal to SD×DH, or to KA×DH; consequently the area lying beyond any ordinate is proportional to that ordinate.

228 These geometrical properties of this curve are all analogous to the chief circumstances in the constitution of the atmosphere, on the supposition of equal gravity. The area MCGN represents the whole quantity of aerial matter which is above C: for CG is the density at C, and CD is the thickness of the stratum between C and D; and therefore CGHD will be as the quantity of matter or air in it; and in like manner of all the others, and of their sums, or the whole area MCGN: and as each ordinate is proportional to the area above it, so each density, and the quantity of air in each stratum, is proportional to the quantity of air above it: and as the whole area MAEN is equal to the rectangle KAEL, so the whole air of variable density above A might be contained in a column KA, if, instead of being compressed by its own weight, it were without weight, and compressed by an external force equal to the pressure of the air at the surface of the earth. In this case, it would be of the uniform density AE, which it has at the surface of the earth, making what we have repeatedly called the homogeneous atmosphere.

229 Hence we derive this important circumstance, that the height of the homogeneous atmosphere is the subtangent of that curve whose ordinates are as the densities of the air at different heights, on the supposition of equal gravity. This curve may with propriety be called the ATMOSPHERICAL LOGARITHMIC; and as the different logarithmics are all characterised by their subtangents, it is of importance to determine this one.

It may be done by comparing the densities of mercury and air. For a column of air of uniform density, reaching to the top of the homogeneous atmosphere, is in equilibrio with the mercury in the barometer. Now it is found, by the best experiments, that when mercury and air are of the temperature 32° of Fahrenheit's thermometer, and the barometer stands at 30 inches, the mercury is nearly 10440 times denser than air. Therefore the height of the homogeneous atmosphere is 10440 times 30 inches, or 26100 feet, or 8700 yards, or 4350 fathoms, or 5 miles wanting 100 yards.

230 Or it may be found by observations on the barometer. It is found, that when the mercury and air are of the above temperature, and the barometer on the sea shore stands at 30 inches, if we carry it to a place 882 feet higher it will fall to 29 inches. Now, in all logarithmic curves having equal ordinates, the portions of the axes intercepted between the corresponding pairs of ordinates are proportional to the subtangents. And the subtangents of the curve belonging to our common tables is 0,4342945, and the difference of the logarithms of 30 and 29 (which is the portion of the axis intercepted between the ordinates 30 and 29), or 0.0147233, is to 0.4342945 as 883 is to 26058 feet, or 8686 yards, or 4342 fathoms, or 5 miles wanting 114 yards. This determination is 14 yards less than the other, and it is uncertain which is the more exact. It is extremely difficult to

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to measure the respective densities of mercury and air; and in measuring the elevation which produces a fall of one inch in the barometer, an error of $\frac{1}{20}$ of an inch would produce all the difference. We prefer the last, as depending on fewer circumstances.

But all this investigation proceeds on the supposition of equal gravity, whereas we know that the weight of a particle of air decreases as the square of its distance from the centre of the earth increases. In order, therefore, 231 that a superior stratum may produce an equal pressure at the surface of the earth, it must be denser, because a particle of it gravitates less. The density, therefore, at equal elevations, must be greater than on the supposition of equal gravity, and the law of diminution of density must be different.

$$\begin{aligned}\text{Make } OD : OA &= OA : O\,d;\\ OC : OA &= OA : O\,c;\\ OB : OA &= OA : O\,b;\ \&c.;\end{aligned}$$

so that O *d*, O *c*, O *b*, OA, may be reciprocals to OD, OC, OB, OA; and through the points A, *b*, *c*, *d*, draw the perpendiculars AE, *bf*, *cg*, *dh*, making them proportional to the densities in A, B, C, D: and let us suppose CD to be exceedingly small, so that the density may be supposed uniform through the whole stratum. Thus we have

$$\begin{aligned}&OD\times O\,d=OA^2=OC\times O\,c\\ \text{and } &O\,c : O\,d=OD : OC;\\ \text{and } &O\,c : O\,c-O\,d=OD : OD-OC,\\ \text{or } &O\,c : c\,d=OD : DC;\\ \text{and } &c\,d : CD=O\,c : OD;\end{aligned}$$

or, because OC and OD are ultimately in the ratio of equality, we have

$$c\,d : CD=O\,c : OC=OA^2 : OC^2,$$

and $c\,d=CD\times\frac{OA^2}{OC^2}$, and $c\,a\times c\,g=CD\times cg\times\frac{OA^2}{OC^2}$; but $CD\times c\,g\times\frac{OA^2}{OC^2}$ is as the pressure at C arising from the absolute weight of the stratum CD. For this weight is as the bulk, as the density, and as the gravitation of each particle jointly. Now CD expresses the bulk, *c g* the density, and $\frac{OA^2}{OC^2}$ the gravitation of each particle. Therefore, $c\,d\times c\,g$ is as the pressure on C arising from the weight of the stratum DC; but $c\,d\times c\,g$ is evidently the element of the curvilineal area A *m n* E, formed by the curve E *f g h n* and the ordinates AE, *b f*, *c g*, *a h*, &c. *m n*. Therefore the sum of all the elements, such as *c d h g*, that is, the area, *c m n g* below *c g*, will be as the *whole* pressure on C, arising from the gravitation of all the air above it; but, by the nature of air, this whole pressure is as the density which it produces, that is, as *c g*. Therefore the curve E *g n* is of such a nature that the area lying below or beyond any ordinate *c g* is proportional to that ordinate. This is the property of the logarithmic curve, and E *g n* is a logarithmic curve.

232 But farther, this curve is the same with EGN. For let B continually approach to A, and ultimately coincide with it. It is evident that the ultimate ratio of BA to A *b*, and of BF to *b f*, is that of equality; and if EFK, E *f k*, be drawn, they will contain equal angles with the ordinate AE, and will cut off equal subtangents AK, A *k*. The curves EGN, E *g n* are therefore the same, but in opposite positions.

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233 Lastly, if OA, O*b*, O*c*, O*d*, &c. be taken in arithmetical progression decreasing, their reciprocals OA, OB, OC, OD, &c. will be in harmonical progression increasing, as is well known: but, from the nature of the logarithmic curve, when O A, O *b*, O *c*, O *d*, &c. are in arithmetical progression, the ordinates AE, *bf*, *cg*, *dh*, &c. are in geometrical progression. Therefore when OA, OB, OC, OD, &c. are in harmonical progression, the densities of the air at A, B, C, D, &c. are in geometrical progression; and thus may the density of the air at all elevations be discovered. Thus to find the density of the air at K the top of the homogeneous atmosphere, make OK : OA=OA : OL, and draw the ordinate LT, LT is the density at K.

The celebrated Dr Halley was the first who observed the relation between the density of the air and the ordinates of the logarithmic curve, or common logarithms. This he did on the supposition of equal gravity; and his discovery is acknowledged by Sir Isaac Newton in *Princip.* ii. *prop.* 22. *schol.* Halley's dissertation on the subject is in N° 185 of the Phil. Trans. Newton, with his usual sagacity, extended the same relation to the true state of the case, where gravity is as the square of the distance inversely; and showed that when the distances from the earth's centre are in harmonic progression, the densities are in geometric progression. He shows indeed, in general, what progression of the distance, on any supposition of gravity, will produce a geometrical progression of the densities, so as to obtain a set of lines OA, O *b*, O*c*, O *d*, &c. which will be logarithms of the densities. The subject was afterwards treated in a more familiar manner by Cotes in his *Hydrost. Lect.* and in his *Harmonia Mensurarum*; also by Dr Brook Taylor, *Meth. Increment.*; Wolf in his *Aerometria*; Herman in his *Phoronomia*; &c. &c. and lately by Horsley, Phil. Trans. tom. lxiv.

234 The air has a finite density at an infinite distance from the centre of the earth

An important corollary is deducible from these principles, viz. that the air has a finite density at an infinite distance from the centre of the earth, namely, such as will be represented by the ordinate OP drawn through the centre. It may be objected to this conclusion, that it would infer an infinity of matter in the universe, and that it is inconsistent with the phenomena of the planetary motions, which appear to be performed in a space void of all resistance, and therefore of all matter. But this fluid must be so rare at great distances, that the resistance will be insensible, even though the retardation occasioned by it has been accumulated for ages. Even at the very moderate distance of 500 miles, the rarity is so great that a cubic inch of common air expanded to that degree would occupy a sphere equal to the orbit of Saturn; and the whole retardation which this planet would sustain after some millions of years would not exceed what would be occasioned by its meeting one bit of matter of half a grain weight.

This being the case, it is not unreasonable to suppose the visible universe occupied by air, which, by its gravitation, will accumulate itself round every body in it, in a proportion depending on their quantities of matter, the larger bodies attracting more of it than the smaller ones, and thus forming an atmosphere about each. And many appearances warrant this supposition. Jupiter, Mars, Saturn, and Venus, are evidently surrounded by atmospheres. The constitution of these atmospheres may differ exceedingly from other causes. If the planet

net has nothing on its surface which can be dissolved by the air or volatilized by heat, the atmosphere will be continually clear and transparent, like that of the moon.

235 The atmosphere of Mars. Mars has an atmosphere which appears precisely like our own, carrying clouds, or depositing snows: for when, by the obliquity of his axis to the plane of his ecliptic, he turns his north pole towards the sun, it is observed to be occupied by a broad white spot. As the summer of that region advances, this spot gradually wastes, and sometimes vanishes, and then the south pole comes in sight, surrounded in like manner with a white spot, which undergoes similar changes. This is precisely the appearance which the snowy circumpolar regions of this earth will exhibit to an astronomer on Mars. It may not, however, be snow that we see; thick clouds will have the same appearances.

236 Of Jupiter. The atmosphere of the planet Jupiter is also very similar to our own. It is diversified by streaks or belts parallel to his equator, which, frequently change their appearance and dimensions, in the same manner as those tracts of similar sky which belong to different regions of this globe. There is a certain kind of weather that more properly belongs to a particular climate than to any other. This is nothing but a certain general state of the atmosphere which is prevalent there, though with considerable variations. This must appear to a spectator in the moon like a streak spread over that climate, distinguishing it from others. But the most remarkable similarity is in the motion of the clouds on Jupiter. They have plainly a motion from east to west relative to the body of the planet; for there is a remarkable spot on the surface of the planet, which is observed to turn round the axis in 9h. 51′ 16″; and there frequently appear variable and perishing spots in the belts, which sometimes last for several revolutions. These are observed to circulate in 9h. 55′. 05″. These numbers are the results of a long series of observations by Dr Herschel. This plainly indicates a general current of the clouds westward, precisely similar to what a spectator in the moon must observe in out atmosphere arising from the trade-winds. Mr Schroeter has made the atmosphere of Jupiter a study for many years; and deduces from his observations that the motion of the variable spots is subject to great variations, but is always from east to west. This indicates variable winds.

237 Of Venus. The atmosphere of Venus appears also to be like ours, loaded with vapours, and in a state of continual change of absorption and precipitation. About the middle of the 17th century the surface of Venus was pretty distinctly seen for many years chequered with irregular spots, which are described by Campani, Bianchini, and other astronomers in the south of Europe, and also by Cassini at Paris, and Hooke and Townley in England. But the spots became gradually more faint and indistinct; and, for near a century, have disappeared. The whole surface appears now of one uniform brilliant white. The atmosphere is probably filled with a reflecting vapour, thinly diffused through it, like water faintly tinged with milk. A great depth of this must appear as white as a small depth of milk itself; and it appears to be of a *very great* depth, and to berefractive like our air. For Dr Herschel has observed, by the help of his fine telescopes, that the illuminated part of Venus is considerably more than a hemisphere, and that the light dies gradually away to the bounding margin. This is the very appearance that the earth would make if furnished with such an atmosphere. The boundary of illumination would have a penumbra reaching about nine degrees beyond it. If this be the constitution of the atmosphere of Venus, she may be inhabited by beings like ourselves. They would not be dazzled by the intolerable splendour of a sun four times as big and as bright, and sixteen times more glaring, than ours: for they would seldom or never see him, but instead of him an uniformly bright and white sky. They would probably never see a star or planet, unless the dog-star and Mercury; and perhaps the earth might pierce through the bright haze which surrounds their planet. For the same reason the inhabitants would not perhaps be incommoded by the sun's heat. It is indeed a very questionable thing, whether the sun would cause any heat, even here, if it were not for the chemical action of his rays on our air. This is rendered not improbable by the intense cold felt on the tops of the highest mountains, in the clearest air, and even under a vertical sun in the torrid zone.

238 And of comets. The atmosphere of comets seems of a nature totally different. This seems to be of inconceivable rarity, even when it reflects a very sensible light. The tail is always turned nearly away from the sun. It is thought that this is by the impulse of the solar rays. If this be the case, we think it might be discovered by the aberration and the refraction of the light by which we see the tail: for this light must come to our eye with a much smaller velocity than the sun's light, if it be reflected by repulsive or elastic forces, which there is every reason in the world to believe; and therefore the velocity of the reflected light will be diminished by all the velocity communicated to the reflecting particles. This is almost inconceivably great. The comet of 1680 went half round the sun in ten hours, and had a tail at least a hundred millions of miles long, which turned round at the same time, keeping nearly in the direction opposite to the sun. The velocity necessary for this is prodigious, approaching to that of light. And perhaps the tail extends much farther than we see it, but is visible only as far as the velocity with which its particles recede from the sun is less than a certain quantity, namely, what would leave a sufficient velocity for the reflected light to enable it to affect our eyes. And it may be demonstrated, that although the real form of the visible tail is concave on the anterior side to which the comet is moving, it may appear convex on that side, in consequence of the very great aberration of the light by which the remote parts are seen. All this may be discovered by properly contrived observations; and the conjecture merits attention. But of this digression there is enough; and we return to our subject, the constitution of our air.

239 The barometer used in taking heights. We have shown how to determine *à priori* the density of the air at different elevations above the surface of the earth. But the densities may be discovered in all accessible elevations by experiments; namely, by observing the heights of the mercury in the barometer. This is a direct measure of the pressure of the incumbent atmosphere; and this is proportional to the density which it produces.

240 Therefore, by means of the relation subsisting between the densities and the elevations, we can discover the elevations by observations made on the densities by means

Barometer. of the barometer; and thus we may measure elevations by means of the barometer; and, with very little trouble, take the level of any extensive tract of country. Of this we have an illustrious example in the section which the Abbé Chappe D'Auteroche has given of the whole country between Brest and Ekaterineburg in Siberia. This is a subject which deserves a minute consideration: we shall therefore present it under a very simple and familiar form; and trace the method through its various steps of improvement by De Luc, Roy, Shuckburgh, &c.

241 Explanation of its use, &c. We have already observed, oftener than once, that if the mercury in the barometer stands at 30 inches, and if the air and mercury be of the temperature 32° in Fahrenheit's thermometer, a column of air 87 feet thick has the same weight with a column of mercury $\frac{1}{10}$ of an inch thick. Therefore, if we carry the barometer to a higher place, so that the mercury sinks to 29.9, we have ascended 87 feet. Now, suppose we carry it still higher, and that the mercury stands at 29.8; it is required to know what height we have now got to? We have evidently ascended through another stratum of equal weight with the former: but it must be of greater thickness, because the air in it is rarer, being less compressed. We may call the density of the first stratum 300, measuring the density by the number of tenths of an inch of mercury which its elasticity proportional to its density enables it to support. For the same reason, the density of the second stratum must be 299: but when the weights are equal, the bulks are inversely as the densities; and when the bases of the strata are equal, the bulks are as the thicknesses. Therefore, to obtain the thickness of this second stratum, say 299:300=87:87.29; and this fourth term is the thickness of the second stratum, and we have ascended in all 174.29 feet. In like manner we may rise till the barometer shows the density to be 298: then say 298 : 30=87 : 87.584 for the thickness of the third stratum, and 261,875 or 261$\frac{7}{8}$ for the whole ascent; and we may proceed in the same way for any number of mercurial heights, and make a table of the corresponding elements as follows: Where the first column is the height of the mercury in the barometer, the second column is the thickness of the stratum, or the elevation above the preceding station; and the third column is the whole elevation above the first station.

Bar.	Strat.	Elev.
30	00.000	00.000
29.9	87.000	87.000
29.8	87.291	174.291
29.7	87.584	261.875
29.6	87.879	349.754
29.5	88.176	437.930
29.4	88.475	526.405
29.3	88.776	615.181
29.2	89.079	704.260
29.1	89.384	793.644
29	89.691	883.335

242 Having done this, we can now measure any elevation within the limits of our table, in this manner.

Observe the barometer at the lower and at the upper stations, and write down the corresponding elevations. Subtract the one from the other, and the remainder is the height required. Thus suppose that at the lower station the mercurial height was 29.8 and that at the upper station it was 29.1

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29.1	793.644
29.8	174.291
	619.353 = Elevation.

We may do the same thing with tolerable accuracy without the table, by taking the medium *m* of the mercurial heights, and their difference *d* in tenths of an inch; and then say, as *m* to 300, so is 87 *d* to the height required *h*: or $h=\frac{300\times 87d}{m}=\frac{26100d}{m}$. Thus, in the foregoing example, *m* is 294.5, and *d* is = 7; and therefore $h=\frac{7\times 26100}{294.5}=620.4$, differing only one foot from the former value.

Either of these methods is sufficiently accurate for most purposes, and even in very great elevations will not produce any error of consequence: the whole error of the elevation 883 feet 4 inches, which is the extent of the above table, is only $\frac{1}{4}$ of an inch.

243 But we need not confine ourselves to methods of approximation, when we have an accurate and scientific method that is equally easy. We have seen that, upon the supposition of equal gravity, the densities of the air are as the ordinates of a logarithmic curve, having the line of elevations for its axis. We have also seen that, in the true theory of gravity, if the distances from the centre of the earth increase in a harmonic progression, the logarithm of the densities will decreas in an arithmetical progression; but if the greatest elevation above the surface be but a few miles, this harmonic progression will hardly differ from an arithmetical one. Thus, if A *b*, A *c*, A *d*, are 1, 2, and 3 miles, we shall find that the corresponding elevations AB, AC, AD are sensibly in arithmetical progression also; for the earth's radius AC is nearly 4000 miles. Hence it plainly follows that BC—AB is $\frac{1}{4000\times 4001}$, or $\frac{1}{16004000}$ of a mile, or $\frac{1}{250}$ of an inch; a quantity quite insignificant. We may therefore affirm without hesitation, that in all accessible places, the elevations increase in an arithmetical progression, while the densities decrease in a geometrical progression. Therefore the ordinates are proportional to the numbers which are taken to measure the densities, and the portions of the axis are proportional to the logarithms of these numbers. It follows, therefore, that we may take such a scale for measuring the densities that the logarithms of the numbers of this scale shall be the very portions of the axis; that is, of the vertical line in feet, yards, fathoms, or what measure we please: and we may, on the other hand, choose such a scale for measuring our elevations, that the logarithms of our scale of densities shall be parts of this scale of elevations; and we may find either of these scales scientifically. For it is a known property of the logarithmic curves, that when the ordinates are the same, the intercepted portion of the abscissæ are proportioned to their subtangents. Now we know the subtangent of the atmospherical logarithmic: it is the height of the homogeneous atmosphere in any measure we please, suppose fathoms: we find this height by comparing the gravities of air and mercury, when

both are of some determined density. Thus, in the temperature of 32° of Fahrenheit's thermometer, when the barometer stands at 30 inches, it is known (by many experiments) that mercury is 10423.068 times heavier than air; therefore the height of the balancing column of homogeneous air will be 10423.068 times 30 inches; that is, 4342.945 English fathoms. Again, it is known that the subtangent of our common logarithmic tables, where 1 is the logarithm of the number 10, is 0.4342945. Therefore the number 0.4342945 is to the difference D of the logarithms of any two barometric heights as 4342.945 fathoms are to the fathoms F contained in the portion of the axis of the atmospherical logarithmic, which is intercepted between the ordinates equal to these barometrical heights; or that $0.4342945 : D = 4342.945 : F$, and $0.4342945 : 4342.945 = D : F$; but 0.4342945 is the ten-thousandth part of 4342.945, and therefore D is the ten-thousandth part of F.

244 And thus it happens, by mere chance, that the logarithms of the densities, measured by the inches of mercury which their elasticity supports in the barometer, are just the ten-thousandth part of the fathoms contained in the corresponding portions of the axis of the atmospherical logarithmic, Therefore, if we multiply our common logarithms by 1000, they will express the fathoms of the axis of the atmospherical logarithmic; nothing is more easily done. Our logarithms contain what is called the index or characteristic, which is an integer and a number of decimal places. Let us just remove the integer-place four figures to the right hand: thus the logarithm of 60 is 1.7781513, which is one integer and $\frac{7781513}{10000000}$. Multiply this by 10.000, and we obtain $\frac{513}{1001}$ 17781.513, or 17781 $\frac{513}{1000}$.

245 The practical application of all this reasoning is obvious and easy: observe the heights of the mercury in the barometer at the upper and lower stations in inches and decimals; take the logarithms of these, and subtract the one from the other: the difference between them (accounting the four first decimal figures as integers) is the difference of elevation of fathoms.

Example.

Merc. Height at the lower station	29.8	1.4742163
upper station	29.1	1.4638930
Diff. of Log. × 10000		0.0103.233

or 103 fathoms and $\frac{233}{1000}$ of a fathom, which is 619.392 feet, or 619 feet $4\frac{3}{4}$ inches; differing from the approximated value formerly found about $\frac{1}{7}$ an inch.

246 **This method of measuring heights now much improved.** Such is the general nature of the barometric measurement of heights first suggested by Dr Halley; and it has been verified by numberless comparisons of the heights calculated in this way with the same heights measured geometrically. It was indeed in this way that the precise specific gravity of air and mercury was most accurately determined; namely, by observing, that when the temperature of air and mercury was 32, the difference of the logarithms of the mercurial heights were precisely the fathoms of elevation. But it requires many corrections to adjust this method to the circumstances of the case; and it was not till very lately that it has been so far adjusted to them as to become useful. We are chiefly indebted to Mr de Luc for the improvements. The great elevations in Switzerland enabled him to make an immense number of observations, in almost every variety of circumstances. Sir George Shuckburgh also made a great number with most accurate instruments in much greater elevations, in the same country; and he made many chamber experiments for determining the laws of variation in the subordinate circumstances. General Roy also made many to the same purpose. And to these two gentlemen we are chiefly obliged for the corrections which are now generally adopted.

247 **It depends on the specific gravity of air and mercury.** It is easy to perceive that the method, as already expressed, cannot apply to every case: it depends on the specific gravity of air and mercury, combined with the supposition that this is affected *only by a change of pressure*. But since all bodies are expanded by heat, and as there is no reason to suppose that they are equally expanded by it, it follows that a change of temperature will change the relative gravity of mercury and air, even although both suffer the same change of temperature: and since the air may be warmed or cooled when the mercury is not, or may change its temperature independent of it, we may expect still greater variations of specific gravity.

The general effect of an augmentation of the specific gravity of the mercury must be to increase the subtangent of the atmospherical logarithmic; in which case the logarithms of the densities, as measured by inches of mercury, will express measures that are greater than fathoms in the same proportion that the subtangent is increased; or, when the air is more expanded than the mercury, it will require a greater height of homogeneous atmosphere to balance 30 inches of mercury, and a given fall of mercury will then correspond to a thicker stratum of air.

In order, therefore, to perfect this method, we must learn by experiment how much mercury expands by an increase of temperature; we must also learn how much the air expands by the same, or any change of temperature; and how much its elasticity is affected by it. Both these circumstances must be considered in the case of air; for it might happen that the elasticity of the air is not so much affected by heat as its bulk is.

It will, therefore, be proper to state in this place the experiments which have been made for ascertaining these two expansions.

248 **General Roy's experiments on the expansion of mercury.** The most accurate, and the best adapted experiments for ascertaining the expansion of mercury, are those of General Roy, published in the 67th volume of the Philosophical Transactions. He exposed 30 inches of mercury, actually supported by the atmosphere in a barometer, in a nice apparatus, by which it could be made of one uniform temperature through its whole length; and he noted the expansion of it in decimals of an inch. These are contained in the following table; where the first column expresses the temperature by Fahrenheit's thermometer, the second column expresses the bulk of the mercury, and the third column the expansion of an inch of mercury for an increase of one degree in the adjoining temperatures.

TABLE A.

Temp.	Bulk of ☿.	Expan. for 1°.
212°	30.5117	0.0000763
202	30.4888	0.0000787
192	30.4652	0.0000810
182	30.4409	0.0000833
172	30.4159	0.0000857
162	30.3902	0.0000880
152	30.3638	0.0000903
142	30.3367	0.0000923
132	30.3090	0.0000943
122	30.2807	0.0000963
112	30.2518	0.0000983
102	30.2223	0.0001003
92	30.1922	0.0001023
82	30.1615	0.0001043
72	30.1302	0.0001063
62	30.0984	0.0001077
52	30.0661	0.0001093
42	30.0333	0.0001110
32	30.0000	0.0001127
22	29.9662	0.0001143
12	29.9319	0.0001160
2	29.8971	0.0000177
0	29.8901	

249 This table gives rise to some reflections. The scale of the thermometer is constructed on the supposition that the successive degrees of heat are measured by equal increments of bulk in the mercury of the thermometer. How comes it, therefore, that this is not accompanied by equal increments of bulk in the mercury of the column, but that the corresponding expansions of this column do continually diminish: General Roy attributes this to the gradual detachment of elastic matter from the mercury by heat, which presses on the top of the column, and therefore shortens it. He applied a boiling heat to the vacuum a-top, without producing any farther depression; a proof that the barometer had been carefully filled. It had indeed been boiled through its whole length. He had attempted to measure the mercurial expansion in the usual way, by filling 30 inches of the tube with boiled mercury, and exposing it to the heat with the open end uppermost. But here it is evident that the expansion of the tube, and its solid contents, must be taken into the account. The expansion of the tube was found so exceedingly irregular, and so incapable of being determined with precision for the tubes which were to be employed, that he was obliged to have recourse to the method with the real barometer. In this no regard was necessary to any circumstance but the perpendicular height. There was, besides, a propriety in examining the mercury in the very condition in which it was used for measuring the pressure of the atmosphere; because, whatever complication there was in the results, it was the same in the barometer in actual use.

250 The most obvious manner of applying these experiments on the expansion of mercury to our purpose, is to reduce the observed height of the mercury to what it would have been if it were of the temperature 32. Thus, suppose that the observed mercurial height is 29.2, and that the temperature of the mercury is 72°, make 30.1302 : 30=29.2 : 29.0738. This will be the true measure of the density of the air of the standard temperature. In order that we may obtain the exact temperature of the mercury, it is proper that the observation be made by means of a thermometer attached to the barometer-frame, so as to warm and cool along with it.

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Or, this may be done without the help of a table, and with sufficient accuracy, from the circumstance that the expansion of an inch of mercury for one degree diminishes very nearly $\frac{1}{1000}$th part in each succeeding degree. If therefore we take from the expansion at 32° its thousandth part for each degree of any range above it, we obtain a mean rate of expansion for that range. If the observed temperature of the mercury is below 32°, we must *add* this correction to obtain the mean expansion. This rule will be made more exact if we suppose the expansion at 32° to be =0.0001127. Then multiply the observed mercurial height by this expansion, and we obtain the correction, to be subtracted or added according as the temperature of the mercury was above or below 32°. Thus to abide by the former example of 72°. This exceeds 32° by 40: therefore take 40 from 0.0001127, and we have 0.0001087 for the medium expansion for that range. Multiply this by 40, and we have the whole expansion of one inch of mercury, =0.004348. Multiply the inches of mercurial height, viz. 29.2 by this expansion, and we have for the correction 0.12696; which being subtracted from the observed height leaves 29.07304, differing from the accurate quantity less than the thousandth part of an inch. This rule is very easily kept in the memory, and supersedes the use of a table. 251

This correction may be made with all necessary exactness by a rule still more simple; namely, by multiplying the observed height of the mercury by the difference of its temperature from 32°, and cutting off four cyphers before the decimals of the mercurial height. This will seldom err $\frac{1}{100}$ of an inch. We even believe that it is the most exact method within the range of temperatures that can be expected to occur in measuring heights: for it appears, by comparing many experiments and observations, that General Roy's measure of the mercurial expansion is too great, and that the expansion of an inch of mercury between 20° and 70° of Fahrenheit's thermometer does not exceed 0.000102 per degree. Having thus corrected the observed mercurial heights by reducing them to what they would have been if the mercury had been of the standard temperature, the logarithms of the corrected heights are taken, and their difference, multiplied by 10000, will give the difference of elevations in English fathoms. 252

There is another way of applying this correction, fully more expeditious and equally accurate. The difference of the logarithms of the mercurial heights is the measure of the ratio of those heights. In like manner the difference of the logarithms of the observed and corrected heights at any station is the measure of the ratio of those heights. Therefore this last difference of the logarithms is the measure of the correction of this ratio. Now the observed height is to the corrected height nearly as 1 to 1.000102. The logarithm of this ratio, or the difference of the logarithms of 1 and 1.000102, is 0.0000444. This is the correction for each degree that 253 that the temperature of the mercury differs from 32. Therefore multiply 0.0000444 by the difference of the mercurial temperatures from 32, and the products will be the corrections of the respective logarithms.

254 But there is still an easier way of applying the logarithmic correction. If both the mercurial temperatures are the same, the differences of their logarithms will be the same, although each may be a good deal above or below the standard temperature, if the expansion be very nearly equable. The correction will be necessary only when the temperatures at the two stations are different, and will be proportional to this difference. Therefore, if the difference of the mercurial temperatures be multiplied by 0.0000444, the product will be the correction to be made on the difference of the logarithms of the mercurial heights.

But farther, since the differences of the logarithms of the mercurial heights are also the differences of elevation in English fathoms, it follows that the correction is also a difference of elevation in English fathoms, or that the correction for one degree of difference of mercurial temperature is $\frac{444}{1000}$ of a fathom, or 32 inches, or 2 feet 8 inches.

This correction of 2.8 for every degree of difference of temperature must be subtracted from the elevation found by the general rate, when the mercury at the upper station is colder than that at the lower. For when this is the case, the mercurial column at the upper station will appear too short, the pressure of the atmosphere too small, and therefore the elevation in the atmosphere will appear greater than it really is.

255 Therefore the rule for this correction will be to multiply 0.0000444 by the degrees of difference between the mercurial temperatures at the two stations, and to add or subtract the product from the elevation found by the general rule, according as the mercury at the upper station is hotter or colder than at the lower.

256 If the experiments of General Roy on the expansion of the mercury in a real barometer be thought most deserving of attention, and the expansion be considered as variable, the logarithmic difference corresponding to this expansion for the *mean* temperature of the two barometers may be taken. These logarithmic differences are contained in the following table, which is carried as far as 112°, beyond which it is not probable that any observations will be made. The number for each temperature is the difference between the logarithms of 30 inches of the temperature 32, and of 30 inches expanded by that temperature.

TABLE B.

Temp.	Long. diff.	Dec. of Fath.	Ft. In.
112°	0.0000427	.427	2.7
102	0.0000436	.436	2.7
92	0.0000444	.444	2.8
82	0.0000453	.453	2.9
72	0.0000460	.460	2.9
62	0.0000468	.468	2.10
52	0.0000475	.475	2.10
42	0.0000482	.482	2.11
32	0.0000489	.489	2.11
22	0.0000497	.497	3.0
12	0.0000504	.504	3.0
0			

257 It is also necessary to attend to the temperature of the air; and the change that is produced by heat in its density is of much greater consequence than that of the mercury. The relative gravity of the two, on which the subtangent of the logarithmic curve depends, and consequently the unit of our scale of elevations, is much more affected by the heat of the air than by the heat of the mercury.

The temperature of the air must also be attended to.

This adjustment is of incomparably greater difficulty than the former, and we can hardly hope to make it perfect. We shall narrate the chief experiments which have been made on the expansion of air, and deduce from them such rules as appear to be necessary consequences of them, and then notice the circumstances which leave the matter still imperfect.

258 General Roy compared a mercurial and an air thermometer, each of which was graduated arithmetically, that is, the units of the scales were equal bulks of mercury, and equal bulks (perhaps different from the former) of air. He found their progress as in the following table.

Comparison of a mercurial and air thermometer.

TABLE C.

Merc.	Diff.	Air.	Diff.
212	20	212.0	17.6
192	20	194.4	18.2
172	20	176.2	18.8
152	20	157.4	19.4
132	20	138.0	20.0
112	20	118.0	20.8
92	20	97.2	21.6
72	20	75.6	22.6
52	20	53.0	21.6
32	20	31.4	20.0
12		11.4	

259 It has been established by many experiments that equal increments of heat produce equal increments in the bulk of mercury. The differences of temperature are therefore expressed by the second column, and may be considered as equal; and the numbers of the third column must be allowed to express the same temperatures with those of the first. They *directly* express the *bulks* of the air, and the numbers of the fourth column express the difference of these bulks. These are evidently unequal, and show that common air expands most of all when of the temperature 62 nearly.

260 The next point was to determine what was the *actual* increase of bulk by some known increase of heat. For this purpose he took a tube, having a narrow bore, and a ball at one end. He measured with great care the capacity of both the ball and the tube, and divided the tube into equal spaces which bore a determined proportion to the capacity of the ball. This apparatus was set in a long cylinder filled with frigorific mixtures or with water, which could be uniformly heated up to the boiling temperature, and was accompanied by a nice thermometer. The expansion of the air was measured by means of a column of mercury which rose or sunk in the tube The tube being of a small bore, the mercury did not drop out of it; and the bore being chosen as equable as possible, this column remained of an uniform length, whatever part of the tube it chanced to occupy. By this contrivance he was able to examine the

To determine an actual increase of bulk from a known increase of heat.

Barometer.

the expanſibility of air of various denſities. When the column of mercury contained only a ſingle drop or two, the air was nearly of the denſity of the external air. If he wiſhed to examine the expanſion of air twice or thrice as denſe, he uſed a column of 30 or 60 inches long; and to examine the expanſion of air that is rarer than the external air, he placed the tube with the ball uppermoſt, the open end coming through a hole in the bottom of the veſſel containing the mixtures or water. By this poſition the column of mercury was hanging in the tube, ſupported by the preſſure of the atmoſphere; and the elaſticity of the included air was meaſured by the difference between the ſuſpended column and the common barometer.

261 The following table contains an expanſion of 1000 parts of air, nearly of the common denſity, by heating it from 0 to 212. The firſt column contains the height of the barometer; the ſecond contains this height augmented by the ſmall column of mercury in the tube of the manometer, and therefore expreſſes the denſity of the air examined; the third contains the total expanſion of 1000 parts; and the fourth contains the expanſion for 1°, ſuppoſing it uniform throughout.

TABLE D.

Barom.	Denſity. of Air examined.	Expanſion of 1000 pts by 212°.	Expanſion by 1°.
29.95	31.52	483.89	2.2825
30.07	30.77	482.10	2.2741
29.48	29.90	480.74	2.2676
29.90	30.73	485.86	2.2918
29.96	30.92	489.45	2.3087
29.90	30.55	476.04	2.2455
29.95	30.60	487.55	2.2998
30.07	30.60	482.80	2.2774
29.48	30.00	489.47	2.3087
Mean	30.62	484.21	2.2840

Hence it appears, that the mean expanſion of 1000 parts of air of the denſity 30.62 by one degree of Fahrenheit's thermometer is 2.284, or that 1000 becomes 1002.284.

262 If this expanſion be ſuppoſed to follow the ſame rate that was obſerved in the compariſon of the mercurial and air thermometer, we ſhall find that the expanſion of a thouſand parts of air for one degree of heat at the different intermediate temperatures will be as in the following table.

TABLE E.

Temp.	Total Expanſion	Expanſion for 1°.	Temp.	Total Expanſion.	Expanſion for 1°.
212	484.210		72	172.671	
192	444.011	2.0099	62	147.090	2.5581
172	402.452	2.0080	52	121.053	2.6037
152	359.503	2.1475	42	95.929	2.5124
132	315.193	2.2155	32	71.718	2.4211
112	269.513	2.2840	22	48.421	2.3297
92	222.006	2.3754	12	26.038	2.2383
82	197.795	2.4211	0		2.1698
72	172.671	2.5124			

If we would have a mean expanſion for any particular range, as between 12° and 92°, which is the moſt likely to comprehend all the geodætical obſervations, we need only take the difference of the bulks 26.038 and 222.006.=195.968, and divide this by the interval of temperature 80°, and we obtain 2.4496, or 2.45 for the mean expanſion for 1°.

Table heights

263 It would perhaps be better to adapt the table to a maſs of 1000 parts of air of the ſtandard temperature 32°; for in its preſent form it ſhows the expanſibility of air originally of the temperature 0. This will be done with ſufficient accuracy by ſaying (for 212°) 1071.718 : 1484.210 = 1000. : 13849, and ſo of the reſt. Thus we ſhall conſtruct the following table of the expanſion of 10,000 parts of air.

TABLE F.

Temp.	Bulk.	Differ.	Expans. for 1°.
212	13489		
192	13474	375	18.7
172	13087	387	19.3
152	12685	392	19.6
132	12272	413	20.6
112	11846	426	21.3
92	11403	443	22.1
82	11177	226	22.6
72	10942	235	23.5
62	10704	238	23.8
52	10461	243	24.3
42	10226	235	23.5
32	10000	226	22.6
22	9783	217	21.7
12	9574	209	20.9
0	9331	243	20.2

This will give for the mean expanſion of 1000 parts of air between 12° and 92=2.29.

264 General Roy's experiments on air above the common denſity.

Although it cannot happen that in meaſuring the differences of elevation near the earth's ſurface, we ſhall have occaſion to employ air greatly exceeding the common denſity, we may inſert the experiments made by General Roy on ſuch airs. They are expreſſed in the following table; where column firſt contains the denſities meaſured by the inches of mercury that they will ſupport when of the temperature 32°: column ſecond is the expanſion of 1000 parts of ſuch air by being heated from 0 to 212; and column third is the mean expanſion for 1°.

TABLE G.

	Denſity.	Expanſion for 212.	Expans for 1°.
	101.7	451.54	2.130
	92.3	423.23	1.996
	80.5	412.09	1.944
	54.5	439.87	2.075
	49.7	443.24	2.091
Mean	75.7	434	2.047

265 And on air below that denſity.

We have much more frequent occaſion to operate in air that is rarer than the ordinary ſtate of the ſuperficial atmosphere. General Roy accordingly made many experiments on such airs. He found in general, that their expansibility by heat was analogous to that of air in its ordinary density, being greatest about the temperature 60°. He found, too, that its expansibility by heat diminished with its density, but he could not determine the law of gradation. When reduced to about one-fifth of the density of common air, its expansion was as follows.

TABLE H.

Temp.	Bulk.	Difference.	Expansion for 1°.
212	1141.504		
192	1134.429	7.075	0.354
172	1122.165	12.264	0.613
152	1108.015	14.150	0.708
132	1093.864	14.151	0.708
112	1079.636	14.228	0.711
92	1064.699	14.937	0.747
72	1043.788	20.911	1.045
52	1017.845	25.943	1.297
32	1000.000	17.845	0.892
	Mean expansion		0.786

266 Air of ordinary density expands most, &c.

From this very extensive and judicious range of experiments, it is evident that the expansibility of air by heat is greatest when the air is about its ordinary density, and that in small densities it is greatly diminished. It appears also, that the law of compression is altered; for in this specimen of the rare air half of the whole expansion happens about the temperature 99°, but in air of ordinary density at 105°. This being the case, we see that the experiments of Mr Amontons, narrated in the Memoirs of the Academy at Paris 1702, &c. are not inconsistent with those more perspicuous experiments of General Roy. Amontons found, that whatever was the density of the air, at least in cases much denser than ordinary air, the change of 180° of temperature increased its elasticity in the same proportion: for he found, that the column of mercury which it supported when of the temperature 50, was increased one-third at the temperature 212. Hence he hastily concluded, that its expansibility was increased in the same proportion; but this by no means follows, unless we are certain that in every temperature the elasticity is proportional to the density. This is a point which still remains undecided; and it merits attention, because if true it establishes a remarkable law concerning the action of heat, which would seem to go to prove that the elasticity of fluids is the property of the matter of fire, which it superinduces on every body with which it combines in the form of vapour.

267 The height which produces a given fall in the barometer, increases with the air's expansion.

After this account of the expansion of air, we see that the height through which we must rise in order to produce a given fall of the mercury in the barometer, or the thickness of the stratum of air equiponderant with a tenth of an inch of mercury, must increase with the expansion of air; and that if $\frac{229}{1000}$ be the expansion for one degree, we must multiply the excess of the temperature of the air above 32° by 0.00229, and multiply the product by 87, in order to obtain the thickness of the stratum where the barometer stands at 30 inches: or whatever be the elevation indicated by the difference of the barometrical heights, upon the supposition that the air is of the temperature 32°, we must multiply this by 0.00229 for every degree that the air is warmer or colder than 32. The product must be added to the elevation in the first case, and subtracted in the latter.

268

Sir George Shuckburgh deduces 0.0024 from his experiments as the mean expansion of air in the ordinary cases: and this is probably nearer the truth; because General Roy's experiments were made on air which was freer from damp than the ordinary air in the fields: and it appears from his experiments, that a very minute quantity of damp increases its expansibility by heat in a prodigious degree.

269 Difficulties in this mode of measuring heights.

The great difficulty is how to apply this correction; or rather, how to determine the temperature of the air in those extensive and deep strata in which the elevations are measured. It seldom or never happens that the stratum is of the same temperature throughout. It is commonly much colder aloft; it is also of different constitutions. Below it is warm, loaded with vapour, and very expansible; above it is cold, much drier, and less expansible, both by its dryness and its rarity. The currents of wind are often disposed in strata, which long retain their places; and as they come from different regions, are of different temperatures and different constitutions. We cannot therefore determine the expansion of the whole stratum with precision, and must content ourselves with an approximation: and the best approximation that we can make is, by supposing the whole stratum of a mean temperature between those of its upper and lower extremity, and employ the expansion corresponding to that mean temperature.

This, however, is founded on a gratuitous supposition, that the whole intermediate stratum expands alike, and that the expansion is equable in the different intermediate temperatures; but neither of these is warranted by experiment. Rare air expands less than what is denser; and therefore the general expansion of the whole stratum renders its density more uniform. Dr Horsley has pointed out some curious consequences of this in Phil. Trans. vol. lxiv. There is a particular elevation at which the general expansion, instead of diminishing the density of the air, increases it by the superior expansion of what is below; and we know that the expansion is not equable in the intermediate temperatures: but we cannot find out a rule which will give us a more accurate correction than by taking the expansion for the mean temperature.

When we have done this, we have carried the method of measuring heights by the barometer as far as it can go; and this source of remaining error makes it needless to attend to some other very minute equations which theory points out. Such is the diminution of the weight of the mercury by the change of distance from the centre of the earth. This accompanies the diminution of the weight of the air, but neither so as to compensate it, nor to go along with it *pari passu*.

After all, there are found cases where there is a regular deviation from those rules, of which we cannot give any very satisfactory account. Thus it is found, that in the province of Quito in Peru, which is at a great elevation above the surface of the ocean, the heights obtained by these rules fall considerably short of the real heights; and at Spitsbergen they considerably exceed them. It appears that the air in the circumpolar regions is denser than the air of the temperate climates when of the same heat and under the same pressure; and the contrary seems to be the case with the air in the torrid zone. It would seem that the specific gravity of air to mercury is at Spitsbergen about 1 to 10224, and in Peru about 1 to 13100. This difference is with great probability ascribed to the greater dryness of the circumpolar air.

This source of error will always remain; and it is combined with another, which should be attended to by all who practise this method of measuring heights, namely, a difference in the specific gravity of the quicksilver. It is thought sufficiently pure for a barometer when it is cleared of all calcinable matter, so as not to drag or sully the tube. In this state it may contain a considerable portion of other metals, particularly of silver, bismuth, and tin, which will diminish its specific gravity. It has been obtained by revivification from cinnabar of the specific gravity 14.229, and it is thought very fine if 13.65. Sir George Shuckburgh found the quicksilver which agreed precisely with the atmospherical observations on which the rules are founded, to have the specific gravity 13.61. It is seldom obtained so heavy. It is evident that these variations will change the whole results; and that it is absolutely necessary, in order to obtain precision, that we know the density of the mercury employed. The subtangent of the atmospherical logarithmic, or the height of the homogeneous atmosphere, will increase in the same proportion with the density of the mercury; and the elevation corresponding to one-tenth of an inch of barometric height will change in the same proportion.

We must be contented with the remaining imperfections: and we can readily see, that, for any purpose that can be answered by such measurements of great heights, the method is sufficiently exact; but it is quite inadequate to the purpose of taking accurate levels, for directing the construction of canals, aqueducts, and other works of this kind, where extreme precision is absolutely necessary.

We shall now deduce from all that has been said on this subject sets of easy rules for the practice of this mode of measurement, illustrating them by an example.

270
Mode of measuring heights by the barometer according to De Luc.

1. *M. DE LUC's Method.*

I. Subtract the logarithm of the barometrical height at the upper station from the logarithm of that at the lower, and count the index and four first decimal figures of the remainder as fathoms, the rest as a decimal fraction. Call this the *elevation.*

II. Note the different temperatures of the mercury at the two stations, and the mean temperature. Multiply the logarithmic expansion corresponding to this mean temperature (in Table B, p. 709.) by the difference of the two temperatures, and subtract the product from the elevation if the barometer has been coldest at the upper station, otherwise add it. Call the difference or the sum the *approximated elevation.*

III. Note the difference of the temperatures of the air at the two stations by a detached thermometer, and also the mean temperature and its difference from 32°. Multiply this difference by the expansion of air for the mean temperature, and multiply the approximate elevation by 1 ± this product, according as the air is above or below 32°. The product is the correct elevation in fathoms and decimals.

Example.

Suppose that the mercury in the barometer at the lower station was at 29.4 inches, that its temperature was 50°, and the temperature of the air was 45; and let the height of the mercury at the upper station be 25.19 inches, its temperature 46, and the temperature of the air 39. Thus we have

☿ al Hts.	Temp. ☿.	Mean.	Temp. Air.	Mean.
29.4	50	48	45	42
25.19	46^{4}		30	

I. Log. of 29.4 - - - 1.4683473
Log. of 25.19 - - 1.4012282

Elevation in fathoms - 671.191

II. Expans. for 48° .473
Multiply - 4
- 1.892

Approximated elevation - 669.299

III. Expans. of air at 42 0.00238
× 42—32,=10° 10

0.0238

Multiply - - 669.2990
By - - - 1.0238

Product = the correct elevation 685.228

2. *Sir GEORGE SHUCKBURGH's Method.*

271
and according to Shuckburgh

I. Reduce the barometric heights to what they would be if they were of the temperature 32°.

II. The difference of the logarithms of the reduced barometrical heights will give the approximate elevation.

III. Correct the approximated elevation as before.

Same Example.

I. Mean expans. for 1° from Tab. A, is 0.000111
18° × 0.000111 × 29.4 = - 0.059
Subtract this from - - 29.4

Reduced barometric height - 29.341
Expans. from Tab. A is 0.000111.
14° × 0.000111 × 25.19 - - 0.039
Subtract from - - 25.190

Reduced barometric height - 25.151

II. Log. 29.341 - - 1.4674749
Log. 25.151 - - 1.4005553

Approximated elevation - 669.196

III. This multiplied by 1.0238 gives 685.125

271
Remarks on this method.

Remark. 1. If 0.000101 be supposed the mean expansion of mercury for 1°, as Sir George Shuckburgh determines it, the reduction of the barometric heights will be had sufficiently exact by multiplying the observed heights of the mercury by the difference of its temperatures from 32, and cutting off four more decimal places; thus $29.4 \times \frac{18}{10000}$ gives the reduced height 29.347, and $25.19 \times \frac{14}{10000}$ gives 25.155, and the difference of their logarithms gives 669.4 fathoms for the approximated elevation, which differs from the one given above by no more than 15 inches.

273 *Remark* 2. If 0.0024 be taken for the expansion of air for one degree, the correction for this expansion will be had by multiplying the approximated elevation by 12, and this product by the sum of the differences of the temperatures from 32°, counting the difference as negative when the temperature is below 32, and cutting off four places; thus $669.196 \times 12 \times \overline{13+07} \times \frac{1}{10000} = 16.061$, which added to 669.196 gives 685.257, differing from the former only 9 inches.

274 An easy rule without the help of tables.

From the same premises we may derive a rule, which is abundantly exact for all geodætical purposes, and which requires no tables of any kind, and is easily remembered.

1. The height through which we must rise in order to produce any fall of the mercury in the barometer, is inversely proportional to the density of the air, that is, to the height of the mercury in the barometer.

2. When the barometer stands at 30 inches, and the air and quicksilver are of the temperature 32, we must rise through 87 feet, in order to produce a depression of $\frac{1}{10}$ of an inch.

3. But if the air be of a different temperature, this 87 feet must be increased or diminished by 0.21 of a foot for every degree of difference of the temperature from 32°.

4. Every degree of difference of the temperatures of the mercury at the two stations makes a change of 2.833 feet, or 2 feet 10 inches in the elevation.

Hence the following rule.

275 1. Take the difference of the barometric heights in tenths of an inch. Call this d.

2. Multiply the difference a between 32 and the mean temperature of the air by 21, and take the sum or difference of this product and 87 feet. This is the height through which we must rise to cause the barometer to fall from 30 inches to 29.9. Call this height h.

Let m be the mean between the two barometric heights. Then $\frac{30\,h\,d}{m}$ is the approximated elevation very nearly.

Multiply the difference ∂ of the mercurial temperatures by 2.83 feet, and add this product to the approximated elevation if the upper barometer has been the warmest, otherwise subtract it. The result, that is, the sum or difference, will be the corrected elevation.

Same Example.

$$d = 294 - 251.9 = 42.1$$
$$b = 87 + 10 \times 0.21, = 89.1$$
$$m = \frac{29.4 + 25.19}{2} = 27.29$$

Approx. elevation $= \frac{30 \times 42.1 \times 89.1}{27.29}, = 4123.24$ feet.

Corr. for temp. of mercury, $= 4 \times 2.83$	1132
Corrected elevation in feet - - -	4111.92
Ditto in fathoms - - - - -	685.32

Differing from the former only 15 inches.

276 This rule may be expressed by the following simple and easily remembered formula, where a is the difference between 32° and the mean temperature of the air, d is the difference of barometric heights in tenths of an inch, m is the mean barometric height, ∂ the difference between the mercurial temperatures, and E is the correct elevation. $E = \frac{30(87 \pm 0.21a)d}{m} \pm \partial \times 2.83$.

277 Heights of the most remarkable mountains.

We shall now conclude this subject by an account of some of the most remarkable mountains, &c. on the earth, above the surface of the ocean, in feet.

Mount Puy de Domme in Auvergne, the first mountain measured by the barometer -		5088
Mount Blanc -	Alps	15662
Monte Rosa - -		15084
Aiguille d'Argenture -		13402
Monastery of St Bernard - - -		7944
Mount Cenis - - -		9212
Pic de los Reyes - - -	Pyrenees	7620
Pic du Médi -		9300
Pic d'Ossano - -		11700
Canegou - - -		8544
Lake of Geneva - - - - - -		1232
Mount Ætna - - - - - -		10954
Mount Vesuvius - - - -		3938
Mount Hekla in Iceland - - - -		4887
Snowdown - - - - - - -		3555
Ben More - - - - - -		3723
Ben Lawers - - - - - -		3858
Ben Gloe - - - - - -		3472
Schehallion - - - - - - -		3461
Ben Lomond - - - - - - -		3180
Tinto - - - - - - -		2342
Table Hill, Cape of Good Hope -		3454
Gondar city in Abyssinia - - -		8440
Source of the Nile - - - - -		8082
Pic of Teneriffe - - - - -		14026
Chimboraço - - - - - -		19595
Cayambourow - - - - - -		19391
Antisana - - - - - -		19290
Pinchinha (see Peru, N° 56.) - -		15670
City of Quito (see ditto) - - - -		9977
Caspian sea below the ocean - - - -		306

This last is so singular, that it is necessary to give the authority on which this determination is founded. It is deduced from nine years observations with the barometer at Astrachan by Mr Lecre, compared with a series of observations made with the same barometer at St Petersburgh.

278 Improved barometers, with a description of Hooke's.

This employment of the barometer has caused it to become a very interesting instrument to the philosopher and to the traveller; and many attempts have been made of late to improve it, and render it more portable. The improvements have either been directed to the enlargement of its range, or to the more accurate measurement of its present scale. Of the first kind are Hooke's wheel barometer, the diagonal barometer, and the horizontal barometer, described in a former part of this work. See BAROMETER. In that place are also described two very ingenious contrivances of Mr Rownings, which are evidently not portable. Of all the barometers with an enlarged scale, the best is that invented by Dr Hooke in 1668, and described in the Phil. Trans. N° 185. The invention was also claimed by Huyghens and by De la Hire; but Hooke's was published long before.

Plate ccccxxx. fig. 73.

It consists of a compound tube ABCDEFG (fig. 73.), of which the parts AB and DE are equally wide, and EFG as much narrower as we would amplify the scale. The parts AB and EG must also be as perfectly cylindrical as possible. The part HBCDI is filled with mercury, having a vacuum above in AB. IF is filled with a light fluid, and FG with another light fluid which will not mix with that in IF. The cistern G is of the same diameter as AB. It is easy to see that the range of the separating surface at F must be as much greater than that of the surface I as the area of I is greater than that of F. And this ratio is in our choice. This barometer is free from all the bad qualities of those formerly described, being most delicately moveable; and is by far the fittest for a chamber, for amusement, by observations on the changes of the atmospheric pressure. The slightest breeze causes it to rise and fall, and it is continually in motion.

279 Inferior to the common one for the measurement of heights.

But this, and all other contrivances of the kind, are inferior to the common barometer for measurement of heights, on account of their bulk and cumbersomeness: nay, they are inferior for all philosophical purposes in point of accuracy; and this for a reason that admits of no reply. Their scale must be determined in all its parts by the common barometer; and, therefore, notwithstanding their great range, they are susceptible of no greater accuracy than that with which the scale of a common barometer can be observed and measured. This will be evident to any person who will take the trouble to consider how the points of their scale must be ascertained. The most accurate method for graduating such a barometer as we have now described would be to make a mixture of vitriolic acid and water, which should have $\frac{1}{10}$ of the density of mercury. Then, let a long tube stand vertical in this fluid, and connect its upper end with the open end of the barometer by a pipe which has a branch to which we can apply the mouth. Then if we suck through this pipe, the fluid will rise both in the barometer and in the other tube; and 10 inches rise in this tube will correspond to one inch descent in the common barometer. In this manner may every point of the scale be adjusted in due proportion to the rest. But it still remains to determine what particular point of the scale corresponds to some determined inch of the common barometer. This can only be done by an actual comparison; and this being done, the whole becomes equally accurate. Except therefore for the mere purpose of chamber amusement, in which case the barometer last described has a decided preference, the common barometer is to be preferred; and our attention should be entirely directed to its improvement and portability.

280 How the common one might be improved.

For this purpose it should be furnished with two microscopes or magnifying glasses, one of them stationed at the beginning of the scale; which should either be moveable, so that it may always be brought to the surface of the mercury in the cistern, or the cistern should be so contrived that its surface may always be brought to the beginning of the scale. The glass will enable us to see the coincidence with accuracy. The other microscope must be moveable, so as to be set opposite to the surface of the mercury in the tube; and the scale should be furnished with a vernier which divides an inch into 1000 parts, and be made of materials of which we know the expansion with great precision.—See the article BAROMETRICAL MEASUREMENTS in the SUPPLEMENT; and for an account of many ingenious contrivances to make the instruments accurate, portable, and commodious, consult Magellan, *Disser. de diverses Instr. de Phys.*; *Phil. Trans.* lxvii. lxviii.; *Journ. de Phys.* xix. 108. 346. xvi. 392. xviii. 391. xxi. 436. xxii. 390.; Sulzer, *Act. Helvet.* iii. 259.; De Luc, *Recherches sur les Modifications de l'Atmosphere*, i. 401. ii. 459, 490. De Luc's seems the most simple and perfect of them all. Cardinal de Luynes (*Mem. Par.* 1768); Prins. De Luc, *Recherches*, § 63.; Van Swinden's *Positiones Physicæ*; *Com. Acad. Petrop.* i.; *Com. Acad. Petrop. Nov.* ii. 200. viii.

281

THUS we have given an elementary account of the distinguishing properties of air as a heavy and compressible fluid, and of the general phenomena which are immediate consequences of these properties. This we have done in a set of propositions analogous to those which form the doctrines of hydrostatics. It remains to consider it in another point of view, namely, as moveable and inert. The phenomena consequent on these properties are exhibited in the velocities which air acquires by pressure, in the resistance which bodies meet with to their motion through the air, and in the impression which air in motion gives to bodies exposed to its action.

We shall first consider the motions of which air is susceptible when the equilibrium of pressure (whether arising from its weight or its elasticity) is removed; and in the next place, we shall consider its action on solid bodies exposed to its current, and the resistance which it makes to their motion through it.

282 Doctrine of air in accessible situations as acted on by equal and parallel gravity,

In this consideration we shall avoid the extreme of generality, which renders the discussion too abstract and difficult, and adapt our investigation to the circumstances in which compressible fluids (of which air is taken for the representative) are most commonly found. We shall consider air therefore as it is commonly found in accessible situations, as acted on by equal and parallel gravity; and we shall consider it in the same order in which water is treated in a system of hydraulics.

283 analogous to the doctrine of water in hydraulics.

In that science the leading problem is to determine with what velocity the water will move through a given orifice when impelled by some known pressure; and it has been found, that the best form in which this most difficult and intricate proposition can be put, is to determine the velocity of water flowing through this orifice when impelled by its weight alone. Having determined this, we can reduce to this case every question which can be proposed; for, in place of the pressure of any piston or other mover, we can always substitute a perpendicular column of water or air whose weight shall be equal to the given pressure.

284 The velocity with which air rushes into a void by its own weight.

The first problem, therefore, is to determine with what velocity air will rush into a void when impelled by its weight alone. This is evidently analogous to the hydraulic problem of water flowing out of a vessel.

And here we must be contented with referring our readers to the solutions which have been given of that problem, and the demonstration that it flows with the velocity which a heavy body would acquire by falling from a height equal to the depth of the hole under the surface of the water in the vessel. In whatever way we attempt to demonstrate that proposition, every step, nay, every word, of the demonstration applies equally to the air, or to any fluid whatever. Or, if our readers should wish to see the connection or analogy of the cases, we only desire them to recollect an undoubted maxim in the science of motion, that *when the moving force and the matter to be moved vary in the same proportion, the velocity will be the same.* If therefore there be similar vessels of air, water, oil, or any other fluid, all of the height of a homogeneous atmosphere, they will all run through equal and similar holes with the same velocity; for in whatever proportion the quantity of matter moving through the hole be varied by a variation of density, the pressure which forces it out, by acting in circumstances perfectly similar, varies in the same proportion by the same variation of density.

We must therefore assume it as the leading proposition, that *air rushes from the atmosphere into a void with the velocity which a heavy body would acquire by falling from the top of a homogeneous atmosphere.*

It is known that air is about 840 times lighter than water, and that the pressure of the atmosphere supports water at the height of 33 feet nearly. The height therefore of a homogeneous atmosphere is nearly 33×840, or 27720 feet. Moreover, to know the velocity acquired by any fall, recollect that a heavy body by falling one foot acquires the velocity of 8 feet per second; and that the velocities acquired by falling through different heights are as the square roots of the heights. Therefore to find the velocity corresponding to any height, expressed in feet per second, multiply the square root of the height by 8. We have therefore in the present instance $V = \sqrt{27220}, = 8 \times 166.493, = 1332$ feet per second. This therefore is the velocity with which common air will rush into a void; and this may be taken as a standard number in pneumatics, as 16 and 32 are standard numbers in the general science of mechanics, expressing the action of gravity at the surface of the earth.

It is easy to see that greater precision is not necessary in this matter. The height of a homogeneous atmosphere is a variable thing, depending on the temperature of the air. If this reason seems any objection against the use of the number 1332, we may retain $8\sqrt{H}$ in place of it, where H expresses the height of a homogeneous atmosphere of the given temperature. A variation of the barometer makes no change in the velocity, nor in the height of the homogeneous atmosphere, because it is accompanied by a proportional variation in the density of the air. When it is increased $\frac{1}{10}$, for instance, the density is also increased $\frac{1}{10}$; and thus the expelling force and the matter to be moved are changed in the same proportion, and the velocity remains the same. N. B. We do not here consider the velocity which the air acquires after its issuing into the void by its continual expansion. This may be ascertained by the 39th prop. of Newton's *Principia*, b. i. Nay, which appears very paradoxical, if a cylinder of air, communicating in this manner with a void, be compressed by a piston loaded with a weight, which presses it down as the air flows out, and thus keep it of the same density, the velocity of efflux will still be the same, however great the pressure may chance to be: for the first and immediate effect of the load on the piston is to reduce the air in the cylinder to such a density that its elasticity shall exactly balance the load; and because the elasticity of air is proportional to its density, the density of the air will be increased in the same proportion with the load, that is, with the expelling power (for we are neglecting at present the weight of the included air as too inconsiderable to have any sensible effect). Therefore, since the matter to be moved is increased in the same proportion with the pressure, the velocity will be the same as before.

285 and the velocity with which it rushes into a space containing rarer air.

It is equally easy to determine the velocity with which the air of the atmosphere will rush into a space containing rarer air. Whatever may be the density of this air, its elasticity, which follows the proportion of its density, will balance a proportional part of the pressure of the atmosphere; and it is the excess of this last only which is the moving force. The matter to be moved is the same as before. Let D be the natural density of the air, and δ the density of the air contained in the vessel into which it is supposed to run, and let P be the pressure of the atmosphere, and therefore equal to the force which impels it into a void; and let π be the force with which this rarer air would run into a void. We have $D : \delta = P : \pi$, and $\pi = \frac{P\delta}{D}$. Now the moving force in the present instance is $P - \pi$, or $P - \frac{P\delta}{D}$. Lastly, let V be the velocity of air rushing into a void, and v the velocity with which it will rush into this rarefied air.

It is a theorem in the motion of fluids, that the pressures are as the squares of the velocities of efflux. Therefore $P : P - \frac{P\delta}{D} = V^2 : v^2$. Hence we derive $v^2 = V^2 \times \overline{1 - \frac{\delta}{D}}$, and $v \times V = \sqrt{1 - \frac{\delta}{D}}$. We do not here consider the resistance which the air of the atmosphere will meet with from the inertia of that in the vessel which it must displace in its motion.

Here we see that there will always be a current into the vessel while δ is less than D.

We also learn the gradual diminution of the velocity as the vessel fills; for δ continually increases, and therefore $1 - \frac{\delta}{D}$ continually diminishes.

It remains to determine the time t expressed in seconds, in which the air of the atmosphere will flow into this vessel from its state of vacuity till the air in the vessel has acquired any proposed density δ.

For this purpose let H, expressed in feet, be the height through which a heavy body must fall in order to acquire the velocity V, expressed also in feet per second. This we shall express more briefly in future, by calling it the height producing the velocity V. Let C represent the capacity of the vessel, expressed in cubic feet, and O the area or section of the orifice, expressed in superficial or square feet; and let the natural density of the air be D.

Since the quantity of aerial matter contained in a vessel depends on the capacity of the vessel and the density of the air jointly, we may express the air which would fill this vessel by the symbol CD when the air is in its ordinary state, and by $C\delta$ when it has the density δ. In order to obtain the rate at which it fills, we must take the fluxion of this quantity $C\delta$. This is $C\dot{\delta}$; for C is a constant quantity, and δ is a variable or flowing quantity.

But we also obtain the rate of influx by our knowledge of the velocity, and the area of the orifice, and the density. The velocity is V, or $8\sqrt{H}$, at the first instant; and when the air in the vessel has acquired the density δ, that is, at the end of the time t, the velocity is $8\sqrt{H}\sqrt{1-\frac{\delta}{D}}$, or $8\sqrt{H}\sqrt{\frac{D-\delta}{D}}$, or $8\sqrt{H}\frac{\sqrt{D-\delta}}{\sqrt{D}}$.

The rate of influx therefore (which may be conceived as measured by the little mass of air which will enter during the time $\dot{t}$ with this velocity) will be $\frac{8\sqrt{H}OD\sqrt{D-\delta}\,\dot{t}}{\sqrt{D}}$, or $8\sqrt{H}O\sqrt{D}\sqrt{D-\delta}\,\dot{t}$, multiplying the velocity by the orifice and the density.

Here then we have two values of the rate of influx. By stating them as equal we have a fluxionary equation, from which we may obtain the fluents, that is, the time t in seconds necessary for bringing the air in the vessel to the density δ, or the density δ which will be produced at the end of any time t. We have the equation $8\sqrt{H}O\sqrt{D}\sqrt{D-\delta}\,\dot{t}=C\dot{\delta}$. Hence we derive $\dot{t}=\frac{C}{8\sqrt{H}O\sqrt{D}}\times\frac{\dot{\delta}}{\sqrt{D-\delta}}$. Of this the fluent is $t=\frac{C}{4\sqrt{H}O\sqrt{D}}\times\sqrt{D-\delta}+A$, in which A is a conditional constant quantity. The condition which determines it is, that t must be nothing when δ is nothing, that is, when $\sqrt{D-\delta}=\sqrt{D}$; for this is evidently the case at the beginning of the motion. Hence it follows, that the constant quantity is $\sqrt{D}$, and the complete confluent, suited to the case, is

$$\frac{C}{4\sqrt{H}O\sqrt{D}}\times\overline{\sqrt{D}-\sqrt{D-\delta}}.$$

The motion ceases when the air in the vessel has acquired the density of the external air; that is, when $\delta=D$, or when $t=\frac{C}{4\sqrt{H}O\sqrt{D}}\times\sqrt{D},=\frac{C}{4\sqrt{H}O}$. Therefore the time of completely filling the vessel is $\frac{C}{4\sqrt{H}O}$.

286 Illustrated by examples in numbers.

Let us illustrate this by an example in numbers.

Supposing then that air is 840 times lighter than water, and the height of the homogeneous atmosphere 27720 feet, we have $4\sqrt{H}=666$. Let us further suppose the vessel to contain 8 cubic feet, which is nearly a wine hogshead, and that the hole by which the air of the ordinary density, which we shall make $=1$, enters is an inch square, or $\frac{1}{144}$ of a square foot. Then the time in seconds of completely filling it will be $\frac{8'}{\frac{1}{144}666}$, or $\frac{1152''}{666}$, or $1.7297''$. If the hole is only $\frac{1}{100}$ of a square inch, that is, if its side is $\frac{1}{10}$ of an inch, the time of completely filling the hogshead will be $173''$ very nearly, or something less than three minutes.

If we make the experiment with a hole cut in a thin plate, we shall find the time greater nearly in the proportion of 63 to 100, for reasons obvious to all who have studied hydraulics. In like manner we can tell the time necessary for bringing the air in the vessel to $\frac{1}{4}$ of its ordinary density. The only variable part of our fluent is the coefficient $-\sqrt{D-\delta}$, or $\sqrt{1-\delta}$. Let δ be $=\frac{1}{4}$, then $\sqrt{1-\delta}=\sqrt{\frac{1}{4}}=\frac{1}{2}$, and $1-\sqrt{1-\delta}=\frac{1}{2}$; and the time is $86\frac{1}{2}''$ very nearly when the hole is $\frac{1}{10}$ of an inch wide.

Fig. 81.

287 The velocity of air with the additional impulse of a weight moving down the vessel.

Let us now suppose that the air in the vessel ABCD (fig. 81.) is compressed by a weight acting on the cover AD, which is moveable down the vessel, and is thus expelled into the external air.

The immediate effect of this external pressure is to compress the air and give it another density. The density D of the external air corresponds to its pressure P. Let the additional pressure on the cover of the vessel be p, and the density of the air in the vessel be d. We shall have $P:P+p=D:d$; and therefore $p=P\times\frac{d-D}{D}$. Then, because the pressure which expels the air is the difference between the force which compresses the air in the vessel and the force which compresses the external air, the expelling force is p. And because the quantities of motion are as the forces which similarly produce them, we shall have $P:P\times\frac{d-D}{D}=MV:mv$; where M and m express the quantities of matter expelled, V expresses the velocity with which air rushes into a void, and v expresses the velocity sought. But because the quantities of aerial matter which issue from the same orifice in a moment are as the densities and velocities jointly, we shall have $MV:mv=DVV:dvv,=DV^2:dv^2$. Therefore $P:p\frac{d-D}{D}=DV^2:dv$. Hence we deduce $v=V\sqrt{\frac{d-D}{d}}$.

We may have another expression of the velocity without considering the density. We had $P:P+p=D:d$: therefore $d=\frac{D\times\overline{P+p}}{P}$, and $d-D=\frac{D\times\overline{P+p}}{P}-D$, $=\frac{D\times\overline{P+p}-DP}{P}$, and $\frac{d-D}{d}=\frac{D\times\overline{P+p}-DP}{D\times\overline{P+p}},=\frac{P+p-P}{P+p},=\frac{p}{P+p}$: therefore $v=V\times\sqrt{\frac{p}{P+p}}$, which is a very simple and convenient expression.

288 The effect of the air's elasticity considered. Fig. 81.

Hitherto we have considered the motion of air as produced by its weight only. Let us now consider the effect of its elasticity.

Let ABCD (fig. 81.) be a vessel containing air of any density D. This air is in a state of compression; and if the compressing force be removed it will expand, and its elasticity will diminish along with its density. Its elasticity in any state is measured by the force which keeps it in that state. The force which keeps common air in its ordinary density is the weight of the atmosphere, and is the same with the weight of a column of water 33 feet high. If therefore we suppose that this air, instead of being confined by the top of the vessel, is pressed down by a moveable piston carrying a column of water 33 feet high, its elasticity will balance this pressure as it balances the pressure of the atmosphere; and as it is a fluid, and propagates through every part the pressure exerted on any one part, it will press on any little portion of the vessel by its elasticity in the same manner as when loaded with this column.

The consequence of this reasoning is, that if this small portion of the vessel be removed, and thus a passage be made into a void, the air will begin to flow out with the same velocity with which it would flow when impelled by its weight alone, or with the velocity acquired by falling from the top of a homogeneous atmosphere, or 1332 feet in a second nearly.

But as soon as some air has come out, the density of the remaining air is diminished, and its elasticity is diminished; therefore the expelling force is diminished. But the matter to be moved is diminished in the very same proportion, because the density and elasticity are found to vary according to the same law; therefore the velocity will continue the same from the beginning to the end of the efflux.

This may be seen in another way. Let P be the pressure of the atmosphere, which being the counterbalance and measure of the initial elasticity, is equal to the expelling force at the first instant. Let D be the initial density, and V the initial velocity. Let d be its density at the end of the time t of efflux, and v the contemporaneous velocity. It is plain that at the end of this time we shall have the expelling force $\pi=\frac{Pd}{D}$; for $D:d=P:\pi\left(=\frac{Pd}{D}\right)$.

These forces are proportional to the quantities of motion which they produce; and the quantities of motion are proportional to the quantities of matter M and m and the velocities V and v jointly: therefore we have $P:\frac{Pd}{D}=MV:mv$. But the quantities of matter which escape through a given orifice are as the densities and velocities jointly; that is, $M:m=DV:dv$: therefore $P:\frac{Pd}{D}=DV^2:dv^2$, and $P\times dv^2=\frac{PdDV^2}{D}=PdV^2$, and $V^2=v^2$, and $V=v$, and the velocity of efflux is constant. Hence follows, what appears very unlikely at first sight, that however much the air in the vessel is condensed, it will always issue into a void with the same velocity.

289 uantity f air issu- g into a oid in a iven time, nd the ensity at e end of at time.

In order to find the quantity of aerial matter which will issue during any time t, and consequently the density of the remaining air at the end of this time, we must get the rate of efflux. In the element of time t their issues (by what has been said above) the bulk $8\sqrt{HO}\,t$ (for the velocity V is constant); and therefore the quantity $8\sqrt{HO}\,d\,\dot{t}$. On the other hand, the quantity of air at the beginning was CD, C being the capacity of the vessel; and when the air has acquired the density d, the quantity is Cd, and the quantity run out is $CD-Cd$: therefore the quantity which has run out in the time $\dot{t}$ must be the fluxion of $CD-Cd$, or $-C\dot{d}$. Therefore we have the equation $8\sqrt{HO}\,d\dot{t}=-C\dot{d}$, and $\dot{t}=\frac{-C\dot{d}}{8\sqrt{HO}\,d}$; $=\frac{C}{8\sqrt{HO}}\times-\frac{\dot{d}}{d}$.

The fluent of this is $t=\frac{C}{8\sqrt{HO}}\log. d$. This fluent must be so taken that t may be $=o$ when $d=D$. Therefore the correct fluent will be $t=\frac{C}{8\sqrt{HO}}\log.\frac{D}{d}$, for $\log.\frac{D}{D}=\log. 1,=o$. We deduce from this, that it requires an infinite time for the whole air of a vessel to flow out of it into a void. N. B. By log. d, &c. is meant the hyperbolic logarithm of d, &c.

290 When the vessel emits it into rarer air.

Let us next suppose that the vessel, instead of letting out its air into a void, emits it into air of a less density, which remains constant during the efflux, as we may suppose to be the case when a vessel containing condensed air emits it into the surrounding atmosphere. Let the initial density of the air in the vessel be ∂, and that of the atmosphere D. Then it is plain that the expelling force is $P-\frac{PD}{\partial}$, and that after the time t it is $\frac{Pd}{\partial}-\frac{PD}{\partial}$. We have therefore $P-\frac{PD}{\partial}:\frac{Pd}{\partial}-\frac{PD}{\partial}=MV:mv,=\partial V^2:dv^2$. Whence we derive $v=V\sqrt{\frac{\partial\,\overline{d-D}}{d\,\overline{\partial-D}}}$.

From this equation we learn that the motion will be at an end when $d=D$: and if $\partial=D$ there can be no efflux.

291 Relation between the time and density when issuing into a void.

To find the relation between the time and the density, let H as before be the height producing the velocity V. The height producing the velocity of efflux v must be $H\times\frac{\partial\,\overline{d-D}}{d\,\overline{\partial-D}}$, and the little parcel of air which will flow out in the time t will be $=8\sqrt{HO}\,d\,\dot{t}\sqrt{\frac{\partial\,\overline{d-D}}{d\,\overline{\partial-D}}}$. On the other hand, it is $=-C\dot{d}$.

Hence we deduce the fluxionary equation $\dot{t}=\frac{C\sqrt{\partial-D}}{8\sqrt{HO}\sqrt{\partial}}\times\frac{-\dot{d}}{\sqrt{d^2-Dd}}$. The fluent of this, corrected so as to make $t=O$ when $d=\partial$, is $t=\frac{C\sqrt{\partial-D}}{8\sqrt{HO}\sqrt{\partial}}\times\log.\left(\frac{\partial-\frac{1}{2}D+\sqrt{\partial^2-D\partial}}{d-\frac{1}{2}D+\sqrt{d^2-Dd}}\right)$. And the time of completing the efflux, when $d=D$, is $\dot{t}=\frac{C\sqrt{\partial-D}}{8\sqrt{HO}\sqrt{\partial}}\times\log.\left(\frac{\partial-\frac{1}{2}D+\sqrt{\partial^2-D\partial}}{\frac{1}{2}D}\right)$.

Fig. 82. 292 When issuing from denser into rarer air.

Lastly, let ABCD, CFGH (fig. 82.) be two vessels containing airs of different densities, and communicating by the orifice C, there will be a current from the vessel containing the denser air into that containing the rarer: suppose from ABCD into CFGH.

Let P be the elastic force of the air in ABCD, Q its density, and V its velocity, and D the density of the air in CFGH. And, after the time t, let the density of the air in ABCD be q, its velocity v, and the density of the air in CFGH be δ. The expelling force from ABCD will be $P-\frac{PD}{Q}$ at the first instant, and at the end of the time t it will be $\frac{Pq}{Q}-\frac{P\delta}{Q}$. Therefore we shall have $P-\frac{PD}{Q} : \frac{Pq}{Q}-\frac{P\delta}{Q} = QV^2 : q\,v^2$, which gives $v=V\times\sqrt{\frac{Q\,(q-\delta)}{q(Q-D)}}$, and the motion will cease when $\delta=q$.

Let A be the capacity of the first vessel, and B that of the second. We have the second equation $AQ+BD=Aq+B\delta$, and therefore $\delta=\frac{A\,(Q-q)+BD}{B}$. Substituting this value of δ in the former value of v, we have $v=\times\sqrt{\frac{Q\,[B(q-D)-A\,(Q-q)\,]}{q\,B(Q-D)}}$, which gives the relation between the velocity v and the density q.

In order to ascertain the time when the air in ABCD has acquired the density q, it will be convenient to abridge the work by some substitutions. Therefore make $Q\,(B+A)=M$, $BQD+BQ^2=N$, $BQ-BD=R$ and $\frac{N}{M}=m$. Then, proceeding as before, we obtain the fluxionary equation $8\sqrt{HO}\,q\frac{\sqrt{Mq-N}}{\sqrt{R}\sqrt{q}}\,\dot{t}=\dot{\overline{AQ-Aq}}=-A\dot{q}$, whence $\dot{t}=\frac{A\sqrt{R}}{8\sqrt{HO}\sqrt{M}}\times\frac{q}{\sqrt{q^2-mq}}$ of which the fluent, completed so that $t=o$ when $q=Q$, is $t=\frac{A\sqrt{R}}{8\sqrt{HO}\sqrt{M}}\times\log.\left(\frac{Q-\frac{1}{2}m+\sqrt{(Q^2mQ)}}{q-\frac{1}{2}m+\sqrt{(q^2mq)}}\right)$.

293
When air is expelled by force, as in bellows.

Some of these questions are of difficult solution, and they are not of frequent use in the more important and usual applications of the doctrines of pneumatics, at least in their present form. The cases of greatest use are when the air is expelled from a vessel by an external force, as when bellows are worked, whether of the ordinary form or consisting of a cylinder fitted with a moveable piston. This last case merits a particular consideration; and, fortunately, the investigation is extremely easy.

Fig. 81.

Let AD, fig. 81. be considered as a piston moving downward with the uniform velocity f, and let the area of the piston be n times the area of the hole of efflux, then the velocity of efflux arising from the motion of the piston will be nf. Add this to the velocity V produced by the elasticity of the air in the first question, and the whole velocity will be $V+nf$. It will be the same in the other. The problem is also freed from the consideration of the time of efflux. For this depends now on the velocity of the piston. It is still, however, a very intricate problem to ascertain the relation between the time and the density, even though the piston is moving uniformly; for at the beginning of the motion the air is of common density. As the piston descends, it both expels and compresses the air, and the density of the air in the vessel varies in a very intricate manner, as also its resistance or re-action on the piston. For this reason a piston which moves uniformly by means of an external force will never make an uniform blast by successive strokes; it will always be weaker at the beginning of the stroke. The best way for securing an uniform blast is to employ the external force only for lifting up the piston, and then to let the piston descend by its own weight. In this way it will quickly sink down, compressing the air, till its density and corresponding elasticity exactly balance the weight of the piston. After this the piston will descend equably, and the blast will be uniform. We shall have occasion to consider this more particularly under the head of *PNEUMATICAL Machines*. These observations and theorems will serve to determine the initial velocity of the air in all important cases of its expulsion. The philosopher will learn the rate of its efflux out of one vessel into another; the chemist will be able to calculate the quantities of the different gases which are employed in the curious experiments of the ingenious but unfortunate Lavoisier on Combustion, and will find them extremely different from what he supposed; the engineer will learn how to proportion the motive force of his machine to the quantity of aerial matter which his bellows must supply. But it is not enough, for this purpose, that the air *begin* to issue in the proper quantity; we must see whether it be not affected by the circumstances of its subsequent passage.

294
Passage of air through pipes, &c. similar to the passage of water in conduits.

All the modifications of motion which are observed in water conduits take place also in the passage of air through pipes and holes of all kinds. There is the same diminution of quantity passing through a hole in a thin plate that is observed in water. We know that (abating the small effect of friction) water issues with the velocity acquired by falling from the surface; and yet if we calculate by this velocity and by the area of the orifice, we shall find the quantity of water deficient nearly in the proportion of 63 to 100. This is owing to the water pressing towards the orifice from all sides, which occasions a contraction of the jet. The same thing happens in the efflux of air. Also the motion of water is greatly impeded by all contractions of its passage. These oblige it to accelerate its velocity, and therefore require an increase of pressure to force it through them, and this in proportion to the squares of the velocities. Thus, if a machine working a pump causes it to give a certain number of strokes in a minute, it will deliver a determined quantity of water in that time. Should it happen that the passage of the water is contracted to one half in any part of the machine (a thing which frequently happens at the valves), the water must move through this contraction with twice the velocity that it has in the rest of the passage. This will require four times the force to be exerted on the piston. Nay (which will appear very odd, and is never suspected by engineers), if no part of the passage is narrower than the barrel of the pump, but on the contrary a part much wider, and if the conduit be again contracted to the width of the barrel, an additional force must be applied to the piston to drive the water through this passage, which would not have been necessary if the passage had not been widened in any part. It will require a force equal to the weight of a column of water of the height necessary for communicating a velocity, the square of which is equal to the difference of the squares of the velocities of the water in the wide and the narrow part of the conduit.

The same thing takes place in the motion of air, and therefore all contractions and dilatations must be carefully avoided, when we want to preserve the velocity unimpaired.

295
Air suffers the same retardation along pipes as water, and the necessity of attending to this.

Air also suffers the same retardation in its motion along pipes. By not knowing, or not attending to that, engineers of the first reputation have been prodigiously disappointed in their expectations of the quantity of air which will be delivered by long pipes. Its extreme mobility and lightness hindered them from suspecting that it would suffer any sensible retardation. Dr Papin, a most ingenious man, proposed this as the most effectual method of transferring the action of a moving power to a great distance. Suppose, for instance, that it was required to raise water out of a mine by a water-machine, and that there was no fall of water nearer than a mile's distance. He employed this water to drive a piston, which should compress the air in a cylinder communicating, by a long pipe, with another cylinder at the mouth of the mine. This second cylinder had a piston in it, whose rod was to give motion to the pumps at the mine. He expected, that as soon as the piston at the water-machine had compressed the air sufficiently, it would cause the air in the cylinder at the mine to force up its piston, and thus work the pumps. Dr Hooke made many objections to the method, when laid before the Royal Society, and it was much debated there. But dynamics was at this time an infant science, and very little understood. Newton had not then taken any part in the business of the society, otherwise the true objections would not have escaped his sagacious mind. Notwithstanding Papin's great reputation as an engineer and mechanic, he could not bring his scheme into use in England; but afterwards, in France and in Germany, where he settled, he got some persons of great fortunes to employ him in this project; and he erected great machines in Auvergne and Westphalia for draining mines. But, so far from being effective machines, they would not even begin to move. He attributed the failure to the quantity of air in the pipe of communication, which must be condensed before it can condense the air in the remote cylinder. This indeed is true, and he should have thought of this earlier. He therefore diminished the size of this pipe, and made his water-machine exhaust instead of condensing, and had no doubt but that the immense velocity with which air rushes into a void would make a rapid and effectual communication of power. But he was equally disappointed here, and the machine at the mine stood still as before.

Near a century after this, a very intelligent engineer attempted a much more feasible thing of this kind at an iron-foundery in Wales. He erected a machine at a powerful fall of water, which worked a set of cylinder bellows, the blowpipe of which was conducted to the distance of a mile and a half, where it was applied to a blast furnace. But notwithstanding every care to make the conducting pipe very air-tight, of great size, and as smooth as possible, it would hardly blow out a candle. The failure was ascribed to the impossibility of making the pipe air-tight. But, what was surprising, above ten minutes elapsed after the action of the pistons in the bellows before the least wind could be perceived at the end of the pipe; whereas the engineer expected an interval of 6 seconds only.

[295]
No distinct theory on this subject.

No very distinct theory can be delivered on this subject; but we may derive considerable assistance in understanding the causes of the obstruction to the motion of water in long pipes, by considering what happens to air. The elasticity of the air, and its great compressibility, have given us the distinctest notions of fluidity in general, showing us, in a way that can hardly be controverted, that the particles of a fluid are kept at a distance from each other, and from other bodies, by the corpuscular forces. We shall therefore take this opportunity to give a view of the subject, which did not occur to us when treating of the motion of water in pipes, reserving a further discussion to the articles River, *Water-Works*.

296
How fluids are obstructed in moving along canals.

The writers on hydrodynamics have always considered the obstruction to the motion of fluids along canals of any kind, as owing to something like the friction by which the motion of solid bodies on each other is obstructed; but we cannot form to ourselves any distinct notion of resemblance, or even analogy between them. The fact is, however, that a fluid running along a canal has its motion obstructed; and that this obstruction is greatest in the immediate vicinity of the solid canal, and gradually diminishes to the middle of the stream. It appears, therefore, that the parts of fluids can no more move among each other than among solid bodies, without suffering a diminution of their motion. The parts in physical contact with the sides and bottom are retarded by these immoveable bodies. The particles of the next stratum of fluid cannot preserve their initial velocities without overpassing the particles of the first stratum; and it appears from the fact that they are by this means retarded. They retard in the same manner the particles of the third stratum, and so on to the middle stratum or thread of fluid. It appears from the fact, therefore, that this sort of friction is not a consequence of rigidity alone, but that it is equally competent to fluids. Nay, since it is a matter of fact in air, and is even more remarkable there than in any other fluid, as we shall see by the experiments which have been made on the subject; and as our experiments on the compression of air show us the particles of air ten times nearer to each other in some cases than in others (viz. when we see air a thousand times denser in these cases), and therefore force us to acknowledge that they are not in contact; it is plain that this obstruction has no analogy to friction, which supposes roughness or inequality of surface. No such inequality can be supposed in the surface of an aerial particle; nor would it be of any service in explaining the obstruction, since the particles do not rub on each other, but pass each other at some small and imperceptible distance.

We must therefore have recourse to some other mode of explication. We shall apply this to air only in this place; and, since it is proved by the incontrovertible experiments of Canton, Zimmerman, and others, that water, mercury, oil, &c. are also compressible and perfectly elastic, the argument from this principle, which is conclusive in air, must equally explain the similar phenomenon in hydraulics.

The most highly polished body which we know must be conceived as having an uneven surface when we compare it with the small spaces in which the corpuscular forces are exerted; and a quantity of air moving in a polished pipe may be compared to a quantity of small shot sliding down a channel with undulated sides and bottom. The row of particles immediately contiguous to the sides will therefore have an undulated motion: but this undulation of the contiguous particles of air will not be so great as that of the surface along which they glide; for not only every motion requires force to produce it, but also every change of motion.

297 Particles of air resist a change from a rectilineal to an undulating motion.

The particles of air resist this change from a rectilineal to an undulating motion; and, being elastic, that is, repelling each other and other bodies, they keep a little nearer to the surface as they are passing over an eminence, and their path is less incurvated than the surface. The difference between the motion of the particles of air and the particles of a fluid quite unelastic is, in this respect, somewhat like the difference between the motion of a spring-carriage and that of a common carriage. When the common carriage passes along a road not perfectly smooth, the line described by the centre of gravity of the carriage keeps perfectly parallel to that described by the axis of the wheels, rising and falling along with it. Now let a spring body be put on the same wheels and pass along the same road. When the axis rises over an eminence perhaps half an inch, sinks down again into the next hollow, and then rises a second time, and so on, the centre of gravity of the body describes a much straighter line; for upon the rising of the wheels, the body resists the motion, and compresses the springs, and thus remains lower than it would have been had the springs not been interposed. In like manner, it does not sink so low as the axle does when the wheels go into a hollow. And thus the motion of spring-carriages becomes less violently undulated than the road along which they pass. This illustration will, we hope, enable the reader to conceive how the deviation of the particles next to the sides and bottom of the canal from a rectilineal motion is less than that of the canal itself.

298 and the undulation of the second row of particles will be less than that of the first. Fig. 83.

It is evident that the same reasoning will prove that the undulation of the next row of particles will be less than that of the first, that the undulation of the third row will be less than that of the second, and so on, as is represented in fig. 83. And thus it appears, that while the mass of air has a progressive motion along the pipe or canal, each particle is describing a waving line, of which a line parallel to the direction of the canal is the axis, cutting all these undulations. This axis of each undulated path will be straight or curved as the canal is, and the excursions of the path on each side of its axis will be less and less as the axis of the path is nearer to the axis of the canal.

299 Each particle appears to lose no velocity.

Let us now see what *sensible* effect this will have; for all the motion which we here speak of is imperceptible. It is demonstrated in mechanics, that if a body moving with any velocity be deflected from its rectilineal path by a curved and perfectly smooth channel, to which the rectilineal path is a tangent, it will proceed along this channel with undiminished velocity. Now the path, in the present case, may be considered as perfectly smooth, since the particles do not touch it. It is one of the undulations which we are considering, and we may at present conceive this as without any subordinate inequalities. There should not, therefore, be any diminution of the velocity. Let us grant this of the absolute velocity of the particle; but what we observe is the velocity of the mass, and we judge of it perhaps by the motion of a feather carried along by it. Let us suppose a single atom to be a sensible object, and let us attend to two such particles, one at the side, and the other in the middle: although we cannot perceive the undulations of these particles during their progressive motions, we see the progressive motions themselves. Let us suppose then that the middle particle has moved without any undulation whatever, and that it has advanced ten feet. The lateral particle will also have moved ten feet; but this has not been in a straight line. It will not be so far advanced, therefore, in the direction of the canal; it will be left behind, and will appear to us to have been retarded in its motion: and in like manner each thread of particles will be more and more retarded (apparently only) as it recedes farther from the axis of the canal, or what is usually called the thread of the stream.

300 But on the whole the undulatory motion is a real obstruction.

And thus the observed fact is shown to be a necessary consequence of what we know to be the nature of a compressible or elastic fluid; and that without supposing any diminution in the real velocity of each particle, there will be a diminution of the velocity of the sensible threads of the general stream, and a diminution of the whole quantity of air which passes along it during a given time.

Let us now suppose a parcel of air impelled along a pipe, which is *perfectly smooth*, out of a larger vessel, and issuing from this pipe with a certain velocity. It requires a certain force to change its velocity in the vessel to the greater velocity which it has in the pipe. This is abundantly demonstrated. How long soever we suppose this pipe, there will be no change in the velocity, or in the force to keep it up. But let us suppose that about the middle of this pipe there is a part of it which has suddenly got an undulated surface, however imperceptible. Let us further suppose that the final velocity of the middle thread is the same as before. In this case it is evident that the sum total of the motions of all the particles is greater than before, because the absolute motions of the lateral particles is greater than that of the central particle, which we suppose the same as before. This absolute increase of motion cannot be without an increase of propelling force: the force acting now, therefore, must be greater than the force acting formerly. Therefore, if only the former force had continued to act, the same motion of the central particle could not have been preserved, or the progressive motion of the whole stream must be diminished.

And thus we see that this internal insensible undulatory motion becomes a real obstruction to the sensible motion which we observe, and occasions an expence of power.

301 An additional force necessary for preserving a greater progressive motion.

Let us see what will be the consequence of extending this obstructing surface further along the canal. It must evidently be accompanied by an augmentation of the motion produced, if the central velocity be still kept up; for the particles which are now in contact with the sides do not continue to occupy that situation; the middle particles moving faster *forward* get over them, and in their turn come next the side; and as they are really moving equally fast, but not in the direction into which they are now to be forced, force is necessary for changing the direction also; and this is in addition to the force necessary for producing the undulations so minutely treated of. The consequence of this must be, that an additional force will be necessary for preserving a given progressive motion in a longer *obstructing* pipe, and that the motion produced in a pipe of greater length by a given force will be less than in a shorter one, and the efflux will be diminished.

302 especially through any contraction.

There is another consideration which must have an influence here. Nothing is more irrefragably demonstrated than the necessity of an additional force for producing an efflux through any contraction, even though it should be succeeded by a dilatation of the passage. Now both the inequalities of the sides and the undulations of the motions of each particle are equivalent to a succession of contractions and dilatations; although each of these is next to infinitely small; their number is also next to infinitely great, and therefore the total effect may be sensible.

303 There are besides other obstructions, as angular asperities, &c.

We have hitherto supposed that the absolute velocity of the particles was not diminished; this we did, having assumed that the interval of each undulation of the sides was without inequalities. But this was gratuitous: it was also gratuitous that the sides were only undulated. We have no reason for excluding angular asperities. These will produce, and most certainly often produce, real diminutions in the velocity of the contiguous particles; and this must extend to the very axis of the canal, and produce a diminution of the sum total of motion: and in order to preserve the same sensible progressive motion, a greater force must be employed. This is all that can be meant by saying that there is a resistance to the motion of air through long pipes.

304 and a want of perfect fluidity.

There remains another cause of diminution, viz. the want of perfect fluidity, whether arising from the dissemination of solid particles in a real fluid, or from the viscidity of the fluid. We shall not insist on this at present, because it cannot be shown to obtain in air, at least in any case which deserves consideration. It seems of no importance to determine the motion of air hurrying along with it soot or dust. The effect of fogs on a particular modification of the motion of air has been considered under ACOUSTICS. What has been said on this subject is sufficient for our purpose, as explaining the prodigious and unexpected obstruction to the passage of air through long and narrow pipes. We are able to collect an important maxim from it, viz. that all pipes of communication should be made as wide as circumstances will permit; for it is plain that the obstruction depends on the internal surface, and the force to overcome it must be in proportion to the mass of matter which is in motion. The first increases as the diameter of the pipe, and the last as the square. The obstruction must therefore bear a greater proportion to the whole motion in a small pipe than in a large one.

305 The law of retardation extending from the axis to the sides of the canal unknown.

It were very desirable to know the law by which the retardation extends from the axis to the sides of the canal, and the proportion which subsists between the lengths of the canal and the forces necessary for overcoming the obstructions when the velocity is given; as also whether the proportion of the obstruction to the whole motion varies with the velocity: but all this is unknown. It does not, however, seem a desperate case in air: we know pretty distinctly the law of action among its particles, viz. that their mutual repulsions are inversely as their distances. This promises to enable us to trace the progress of undulation from the sides of the canal to the axis.

306 It will not increase so fast as the square of the velocities.

We can see that the retardations will not increase so fast as the square of the velocity. Were the fluid incompressible, so that the undulatory path of a particle were invariable, the deflecting forces by which each individual particle is made to describe its undulating path would be precisely such as arise from the path itself and the motion in it; for each particle would be in the situation of a body moving along a fixed path. But in a very compressible fluid, such as air, each particle may be considered as a solitary body, actuated by a projectile and a transverse force, arising from the action of the adjoining particles. Its motion must depend on the adjustment of these forces, in the same manner as the elliptical motion of a planet depends on the adjustment of the force of projection, with a gravitation inversely proportional to the square of the distance from the focus. The transverse force in the present case has its origin in the pressure on the air which is propelling it along the pipe: this, by squeezing the particles together, brings their mutual repulsion into action. Now it is the property of a perfect fluid, that a pressure exerted on any part of it is propagated equally through the whole fluid; therefore the transverse forces which are excited by this pressure are proportional to the pressure itself; and we know that the pressures exerted on the surface of a fluid, so as to expel it through any orifice, or along any canal, are proportional to the squares of the velocities which they produce. Therefore, in every point of the undulatory motion of any particle, the transverse force by which it is deflected into a curve is proportional to the square of its velocity. When this is the case, a body would continue to describe the same curve as before; but by the very compression, the curvatures are increased, supposing them to remain similar. This would require an increase of the transverse forces; but this is not to be found: therefore the particle will not describe a similar curve, but one which is less incurvated in all its parts; consequently the progressive velocity of the whole, which is the only thing perceivable by us, will not be so much diminished; that is, the obstructions will not increase so fast as they would otherwise do, or as the squares of the velocities.

This reasoning is equally applicable to all fluids, and is abundantly confirmed by experiments in hydraulics, as we shall see when considering the motion of rivers. We have taken this opportunity of delivering our notions on this subject; because, as we have often said, it is in the avowed discrete constitution of air that we see most distinctly the operations of those natural powers which constitute fluidity in general.

307 M. Bossut's experiments on pipes and canals.

We would beg leave to mention a form of experiment for discovering the law of retardation with considerable accuracy. Experiments have been made on pipes and canals. Mr Bossut, in his *Hydrodynamique*, has given a very beautiful set made on pipes of an inch and two inches diameter, and 200 feet long: but although these experiments are very instructive, they do not give us any rule by which we can extend the result to pipes of greater length and different diameters.

Let a smooth cylinder be set upright in a very large vessel or pond, and be moveable round its axis: let it be turned round by means of a wheel and pulley with an uniform motion and determined velocity. It will exert the same force on the contiguous water which would be exerted on it by water turning round it with the same velocity: and as this water would have its motion gradually retarded by the fixed cylinder, so the moving cylinder will gradually communicate motion to the surrounding water. We should observe the water gradually dragged round by it; and the vortex would extend farther and farther from it as the motion is continued, and the velocities of the parts of the vortex will be less and less as we recede from the axis. Now, we apprehend, that when a point of the surface of the cylinder has moved over 200 feet, the *motion* of the water at different distances from it will be similar and proportional to, if not precisely the same with, the *retardations* of water flowing 200 feet at the same distance from the side of a canal: at any rate, the two are susceptible of an accurate comparison, and the law of retardation may be accurately deduced from observations made on the motions of this vortex.

308
Wind is air in motion.

Air in motion is a very familiar object of observation; and it is interesting. In all languages it has got a name; we call it wind: and it is only upon reflection that we consider air as wind in a quiescent state. Many persons hardly know what is meant when air is mentioned; but they cannot refuse that the blast from the bellows is the expulsion of what they contained; and thus they learn that wind is air in motion.

309
The velocity of wind not easily discovered.

It is of consequence to know the velocity of wind; but no good and unexceptionable method has been contrived for this purpose. The best seems to be by measuring the space passed over by the shadow of a cloud; but this is extremely fallacious. In the first place, it is certain, that although we suppose that the cloud has the velocity of the air in which it is carried along, this is not an exact measure of the current on the surface of the earth; we may be almost certain that it is greater: for air, like all other fluids, is retarded by the sides and bottom of the channel in which it moves. But, in the next place, it is very gratuitous to suppose, that the velocity of the cloud is the velocity of the stratum of air between the cloud and the earth; we are almost certain that it is not. It is abundantly proved by Dr Hutton of Edinburgh, that clouds are always formed when two parcels of air of different temperatures mix together, each containing a proper quantity of vapour in the state of chemical solution. We know that different strata of air will frequently flow in different directions for a long time. In 1781 while a great fleet rendezvouzed in Leith Roads during the Dutch war, there was a brisk easterly wind for about five weeks; and, during the last fortnight of this period, there was a brisk westerly current at the height of about three-fourths of a mile. This was distinctly indicated by frequent fleecy clouds at a great distance above a lower stratum of these clouds, which were driving all this time from the eastward. A gentleman who was at the siege of Quebec in 1759, informed us, that one day while there blew a gale from the west, so hard that the ships at anchor in the river were obliged to strike their topmasts, and it was with the utmost difficulty that some well manned boats could row against it, carrying some artillery stores to a post above the town, several shells were thrown from the town to destroy the boats: one of the shells burst in the air near the top of its flight, which was about half a mile high. The smoke of this bomb remained in the same spot for above a quarter of an hour, like a great round ball, and gradually dissipated by diffusion, without removing many yards from its place. When, therefore, two strata of air come from different quarters, and one of them flows over the other, it will be only in the contiguous surfaces that a precipitation of vapour will be made. This will form a thin fleecy cloud; and it will have a velocity and direction which neither belongs to the upper nor to the lower stratum of air which produced it. Should one of these strata come from the east and the other from the west with equal velocities, the cloud formed between them will have no motion at all; should one come from the east, and the other from the north, the cloud will move from the north-east with a greater velocity than either of the strata. So uncertain then is the information given by the clouds either of the velocity or the direction of the wind. A thick smoke from a furnace will give us a much less equivocal measure; and this combined with the effects of the wind in impelling bodies, or deflecting a loaded plane from the perpendicular, or other effects of this kind, may give us measures of the different currents of wind with a precision sufficient for all practical uses.

310
The result of Smeaton's observations on this head.

The celebrated engineer Mr John Smeaton has given, in the 51st volume of the Philosophical Transactions, the velocities of wind corresponding to the usual denominations in our language. These are founded on a great number of observations made by himself in the course of his practice in erecting wind-mills. They are contained in the following table.

Miles per hour.	Feet per second.	Names.
1	1.47	
2	2.93	Light airs.
3	4.40	
4	5.87	Breeze.
5	7.33	
10	14.67	Brisk gale.
15	22.	
20	29.34	Fresh gale.
25	36.67	
30	44.01	Strong gale.
35	51.34	
40	58.68	Hard gale.
45	66.01	
50	73.35	Storm.
60	88.02	
80	117.36	Hurricane, tearing up trees, overturning buildings, &c.
100	146.70	

See also some valuable experiments by him on this subject, Philosophical Transactions, 1760 and 1761.

311
Account of Dr Lind's anemometer.

One of the most ingenious and convenient methods for measuring the velocity of the wind is to employ its pressure in supporting a column of water, in the same way as Mr Pitot measures the velocity of a current of water. We believe that it was first proposed by Dr James Lind of Windsor, a gentleman eminent for his great knowledge in all the branches of natural science, and for his ingenuity in every matter of experiment or practical application.

Fig. 54

His anemometer (as these instruments are called) consists of a glass tube of the form ABCD (fig. 84.), open at both ends, and having the branch AB at right angles to the branch CD. This tube contains a few inches of water or any fluid (the lighter the better); it is held with the part CD upright, and AB horizontal and in the direction of the wind; that is, with the mouth A fronting the wind. The wind acts in the way of pressure on the air in AB, compresses it, and causes it to press on the surface of the liquor; forcing it down to F, while it rises to E in the other leg. The velocity of the wind is concluded from the difference E*f* between the heights of the liquor in the legs. As the wind does not generally blow with uniform velocity, the liquor is apt to dance in the tube, and render the observation difficult and uncertain: to remedy this, it is proper to contract very much the communication at C between the two legs. If the tube has half an inch of diameter (and it should not have less), a hole of $\frac{1}{30}$ of an inch is large enough; indeed the hole can hardly be too small, nor the tubes too large.

312
It is ingenious and useful.

This instrument is extremely ingenious, and will undoubtedly give the proportions of the velocities of different currents with the greatest precision; for in whatever way the pressure of wind is produced by its motion, we are certain that the different pressures are as the squares of the velocities: if, therefore, we can obtain one certain measure of the velocity of the wind, and observe the degree to which the pressure produced by it raises the liquor, we can at all other times observe the pressures and compute the velocities from them, making proper allowances for the temperature and the height of the mercury in the barometer; because the velocity will be in the subduplicate ratio of the density of the air inversely when the pressure is the same.

It is usually concluded, that the velocity of the wind is that which would be acquired by falling from a height which is to E*f* as the weight of water is to that of an equal bulk of air. Thus, supposing air to be 840 times lighter than water, and that E*f* is $\frac{8}{10}$ of an inch, the velocity will be about 63 feet per second, which is that of a very hard gale, approaching to a storm. Hence we see by the bye, that the scale of this instrument is extremely short, and that it would be a great improvement of it to make the leg CD not perpendicular, but very much sloping; or perhaps the following form of the instrument will give it all the perfection of which it is capable. Let the horizontal branch AB (fig. 85.) be contracted at B, and continued horizontally for several inches BG of a much smaller bore, and then turned down for two or three inches GC, and then upwards with a wide bore. To use this instrument, hold it with the part DC perpendicular; and (having sheltered the mouth A from the wind) pour in water at D till it advances along GB to the point B, which is made the beginning of the scale; the water in the upright branch standing at *f* in the same horizontal line with BG. Now, turn the mouth A to the wind; the air in AB will be compressed and will force the water along BG to F, and cause it to rise from *f* to E; and the range *f*E will be to the range BF on the scale as the section of the tube BG to that of CD. Thus, if the width of DC be $\frac{1}{2}$ an inch, and that of BG $\frac{1}{10}$, we shall have 25 inches in the scale for one inch of real pressure E*f*.

Fig. 85.

But it has not been demonstrated in a very satisfactory manner, that the velocity of the wind is that acquired by falling through the height of a column of air whose weight is equal to that of the column of water E*f*. Experiments made with Pitot's tube in currents of water show that several corrections are necessary for concluding the velocity of the current from the elevations in the tube: these corrections may however be made, and safely applied to the present case; and then the instrument will enable us to conclude the velocity of the wind immediately, without any fundamental comparison of the elevation, with a velocity actually determined upon other principles. The chief use which we have for this information is in our employment of wind as an impelling power, by which we can actuate machinery or navigate ships. These are very important applications of pneumatical doctrines, and merit a particular consideration; and this naturally brings us to the last part of our subject, viz. the consideration of the impulse of air on bodies exposed to its action, and the resistance which it opposes to the passage of bodies through it.

313
This subject is most important, but it is also difficult.

This is a subject of the greatest importance; being the foundation of that art which has done the greatest honour to the ingenuity of man, and the greatest service to human society, by connecting together the most distant inhabitants of this globe, and making a communication of benefits which would otherwise have been impossible; we mean the art of Navigation or Seamanship. Of all the machines which human art has constructed, a ship is not only the greatest and most magnificent, but also the most ingenious and intricate; and the clever seaman possesses a knowledge founded on the most difficult and abstruse doctrines of mechanics. The seaman probably cannot give any account of his own science; and he possesses it rather by a kind of intuition than by any process of reasoning; but the success and efficacy of all the mechanism of this complicated engine, and the propriety of all the manœuvres which the seaman practises, depend on the invariable laws of mechanics; and a thorough knowledge of these would enable an intelligent person not only to understand the machine and the manner of working, but to improve both.

Unfortunately this is a subject of very great difficulty; and although it has employed the genius of Newton, and he has considered it with great care, and his followers have added more to his labours on this subject than on any other, it still remains in a very imperfect state.

A minute discussion of this subject cannot therefore be expected in a work like this: we must content ourselves with such a general statement of the most approved doctrine on the subject as shall enable our readers to conceive it distinctly, and judge with intelligence and confidence of the practical deductions which may be made from it.

314
Impulse and resistance of air.

It is evidently a branch of the general theory of the impulse and resistance of fluids, which belongs to HYDRAULICS, but will be better understood when the mechanical properties of compressible fluids have been considered. It was thought very reasonable to suppose that the circumstances of elasticity would introduce the same changes in the impulse and resistance of fluids that it does in solid bodies. It would greatly divert the attention from the distinctive properties of air, if we should in this place enter on this subject, which is both extensive and difficult. We reckon it better therefore to take the whole together: this we shall do under the article

Resistance of Fluids, and confine ourselves at present to what relates to the impulse and resistance of air alone; anticipating a few of the general propositions of that theory, but without demonstration, in order to understand the applications which may be made of it.

Fig. 86. Suppose then a plane surface, of which a C (fig. 86.) is the section, exposed to the action of a stream of wind blowing in the direction QC, perpendicular to a C. The motion of the wind will be obstructed, and the surface a C pressed forward. And as all impulse or pressure is exerted in a direction perpendicular to the surface, and is resisted in the opposite direction, the surface will be impelled in the direction CD, the continuation of QC. And as the mutual actions of bodies depend on their relative motions, the force acting on the surface a C will be the same, if we shall suppose the air at rest, and the surface moving equally swift in the opposite direction. The resistance of the air to the motion of the body will be equal to the impulse of the air in the former case. Thus resistance and impulse are equal and contrary.

315 Air moving with a double velocity will generally impel as the square of that velocity.

If the air be moving twice as fast, its particles will give a double impulse; but in this case a double number of particles will exert their impulse in the same time: the impulse will therefore be fourfold; and in general it will be as the square of the velocity: or if the air and body be both in motion, the impulse and resistance will be proportional to the square of the relative velocity.

This is the first proposition on the subject, and it appears very consonant to reason. There will therefore be some analogy between the force of the air's impulse or the resistance of a body, and the weight of a column of air incumbent on the surface; for it is a principle in the action of fluids, that the heights of the columns of fluid are as the squares of the velocities which their pressures produce. Accordingly the second proposition is, that the absolute impulse of a stream of air, blowing perpendicularly on any surface, is equal to the weight of a column of air which has that surface for its base, and for its height the space through which a body must fall in order to acquire the velocity of the air.

Thirdly, Suppose the surface AC equal to a C no longer to be perpendicular to the stream of air, but inclined to it in the angle ACD, which we shall call the *angle of incidence;* then, by the resolution of forces, it follows, that the action of each particle is diminished in the proportion of radius to the sine of the angle of incidence, or of AC to AL, AL being perpendicular to CD.

Again: Draw AK parallel to CD. It is plain that no air lying farther from CD than KA is will strike the plane. The quantity of impulse therefore is diminished still farther in the proportion of a C to KC, or of AC to AL. Therefore, on the whole, the absolute impulse is diminished in the proportion of AC^2 to AL^2 hence the proposition, that the impulse and resistance of a given surface are in the proportion of the square of the sine of the angle of incidence.

Fourthly, This impulse is in the direction PL, perpendicular to the impelled surface, and the surface tends to move in this direction: but suppose it moveable only in some other direction PO, or that it is in the direction PO that we wish to employ this impulse, its action is therefore oblique; and if we wish to know the intensity of the impulse in this direction, it must be diminished still farther in the proportion of radius to the cosine of the angle LPO or sine of CPO. Hence the general proposition: The *effective impulse is as the surface, as the square of the velocity of the wind, as the square of the sine of the angle of incidence, and as the sine of the obliquity jointly*, which we may express by the symbol $R = S\cdot V^2\ \sin.^2\cdot I\cdot \sin.\ O$; and as the impulse depends on the density of the impelling fluid, we may take in every circumstance by the equation $R = S\cdot D\cdot V^2\cdot\ \sin.^2\ I\cdot \sin.\ O$. If the impulse be estimated in the direction of the stream, the angle of obliquity ACD is the same with the angle of incidence, and the impulse in this direction is as the surface, as the square of the velocity, and as the cube of the angle of incidence jointly.

It evidently follows from these premises, that if ACA′ be a wedge, of which the base AA′ is perpendicular to the wind, and the angle ACA′ bisected by its direction, the direct or perpendicular impulse on the base is to the oblique impulse on the sides as radius to the square of the sine of half the angle ACA′.

The same must be affirmed of a pyramid or cone ACA′, of which the axis is in the direction of the wind.

Fig. 87. If ACA′ (fig. 87.) represent the section of a solid, produced by the revolution of a curve line APC round the axis CD, which lies in the direction of the wind, the impulse on this body may be compared with the direct impulse on this base, or the resistance to the motion of this body through the air may be compared with the direct resistance of its base, by resolving its surface into elementary planes P p, which are coincident with a tangent plane PR, and comparing the impulse on Pp with the direct impulse on the corresponding part K k of the base.

In this way it follows that the impulse on a sphere is one half of the impulse on its great circle, or on the base of a cylinder of equal diameter.

We shall conclude this sketch of the doctrine with a very important proposition to determine the most advantageous position of a plane surface, when required to move in one direction while it is impelled by the wind blowing in a different direction. Thus,

316 Important inference from this doctrine.

Let AB (fig. 88.) be the sail of a ship, CA the direction in which the wind blows, and AD the line of the ship's course. It is required to place the yard AC in such a position that the impulse of the wind upon the sail may have the greatest effect possible in impelling the ship along AD.

Fig. 88. Let AB, A b, be two positions of the sail very near the best position, but on opposite sides of it. Draw BE $b\,e$, perpendicular to CA, and BF, $b\,f$, perpendicular to AD, calling AB radius; it is evident that BE, BF, are the sines of impulse and obliquity, and that the effective impulse is $BE^2 \times BF$, or $b\,e^2 \times b\,f$. This must be a maximum.

Let the points B, b, continually approach and ultimately coincide; the chord b B will utimately coincide with a straight line CBD touching the circle in B; the triangles CBE, $c\ b\ e$ are similar, as also the triangles DBF, D $b\,f$: therefore $BE^2 : b\,e^2 = BC^2 : b\,c^2$, and $BF : bf = BD : bD$; and $BE^2 \times BF : be^2 \times bf = CB^2 \times BD : cb^2 \times bD$. Therefore when AB is in the dest position, so that $BE^2 \times BF$ is greater than $b\,e^2 \times b\,f$, we shall have $CB \times BD$ greater than $Cb^2 \times b\,D$, or $c\,B^2 \times BD$

is also a maximum. This we know to be the case when CB=2BD: therefore the sail must be so placed that the tangent of the angle of incidence shall be double of the tangent of the angle of the sail and keel.

In a common windmill the angle CAD is necessarily a right angle; for the sail moves in a circle to which the wind is perpendicular: therefore the best angle of the sail and axle will be 54°.44 nearly.

Such is the theory of the resistance and impulse of the air. It is extremely simple and of easy application. In all physical theories there are assumptions which depend on other principles, and those on the judgment of the naturalist; so that it is always proper to confront the theory with experiment. There are even circumstances in the present case which have not been attended to in the theory. When a stream of air is obstructed by a solid body, or when a solid body moves along in air, the air is condensed before it and rarefied behind. There is therefore a pressure on the anterior parts arising from this want of equilibrium in the elasticity of the air. This must be superadded to the force arising from the impetus or inertia of the air. We cannot tell with precision what may be the amount of this condensation; it depends on the velocity with which any condensation diffuses itself.

Also, if the motion be so rapid that the pressure of the atmosphere cannot make the air immediately occupy the place quitted by the body, it will sustain this pressure on its fore part to be added to the other forces.

317
Account of the principal experiments on this subject.

Experiments on this subject are by no means numerous; at least such experiments as can be depended on for the foundation of any practical application. The first that have this character are those published by Mr Robins in 1742 in his treatise on Gunnery. They were repeated with some additions by the Chevalier Borda, and some account of them published in the Memoirs of the Academy of Sciences in 1763. In the Philosophical Transactions of the Royal Society of London, vol. lxxiii. there are some experiments of the same kind on a larger scale by Mr Edgeworth. These were all made in the way described in our account of Mr Robins's improvements in gunnery. Bodies were made to move with determined velocities, and the resistances were measured by weights.

In all these experiments the resistances were found very exactly in the proportion of the squares of the velocities; but they were found considerably greater than the weight of the column of air, whose height would produce the velocity in a falling body. Mr Robins's experiments on a square of 16 inches, describing 25.2 feet per second, indicate the resistance to be to this weight nearly as 4 to 3. Borda's experiments on the same surface state the disproportion still greater.

The resistances are found not to be in the proportion of the surfaces, but increase considerably faster. Surfaces of 9, 16, 36, and 81 inches, moving with one velocity, had resistances in the proportion of 9, $17\frac{1}{8}$, $42\frac{1}{4}$, and $104\frac{1}{3}$.

Now as this deviation from the proportion of the surfaces increases with great regularity, it is most probable that it continues to increase in surfaces of still greater extent; and these are the most generally to be met with in practice in the action of wind on ships and mills.

Borda's experiments on 81 inches show that the impulse of wind moving one foot per second is about $\frac{1}{500}$ of a pound on a square foot. Therefore to find the impulse on a foot corresponding to any velocity, divide the square of the velocity by 500, and we obtain the impulse in pounds. Mr Rouse of Leicestershire made many experiments, which are mentioned with great approbation by Mr Smeaton. His great sagacity and experience in the erection of windmills oblige us to pay a considerable deference to his judgment. These experiments confirm our opinion, that the impulses increase faster than the surfaces. The following table was calculated from Mr Rouse's observations, and may be considered as pretty near the truth.

Velocity in Feet.	Impulse on a Foot in Pounds.
0	0,000
10	0,229
20	0,915
30	2,059
40	3,660
50	5,718
60	8,234
70	11,207
80	14,638
90	18,526
100	22,872
110	27,675
120	32,926
130	38,654
140	44,830
150	51,462

If we multiply the square of the velocity in feet by 16, the product will be the impulse or resistance in a square foot in grains, according to Mr Rouse's numbers.

The greatest deviation from the theory occurs in the oblique impulses. Mr Robins compared the resistance of a wedge, whose angle was 90°, with the resistance of its base; and instead of finding it less in the proportion of $\sqrt{2}$ to 1, as determined by the theory, he found it greater in the proportion of 55 to 68 nearly; and when he formed the body into a pyramid, of which the sides had the same surface and the same inclination as the sides of the wedge, the resistance of the base and face were now as 55 to 39 nearly: so that here the same surface with the same inclination had its resistance reduced from 68 to 39 by being put into this form. Similar deviations occur in the experiments of the Chevalier Borda; and it may be collected from both, that the resistances diminish more nearly in the proportion of the sines of incidence than in the proportion of the squares of those sines.

The irregularity in the resistance of curved surfaces is as great as in plane surfaces. In general, the theory gives the oblique impulses on plane surfaces much too small, and the impulses on curved surfaces too great. The resistance of a sphere does not exceed the fourth part of the resistance of its great circle, instead of being its half; but the anomaly is such as to leave hardly any room for calculation. It would be very desirable to have the experiments on this subject repeated in a greater variety of cases, and on larger surfaces, so that the errors of the experiments may be of less consequence.

Till this matter be reduced to some rule, the art of working ships must remain very imperfect, as must also the construction of windmills.

318 It is of great consequence to know the resistance of air in the motion of bullets, &c.

The case in which we are most interested in the knowledge of the resistance of the air is the motion of bullets and shells. Writers on artillery have long been sensible of the great effect of the air's resistance. It seems to have been this consideration that chiefly engaged Sir Isaac Newton to consider the motions of bodies in a resisting medium. A proposition or two would have sufficed for showing the incompatibility of the planetary motions with the supposition that the celestial spaces were filled with a fluid matter; but he has with great solicitude considered the motion of a body projected on the surface of the earth, and its deviation from the parabolic track assigned by Galileo. He has bestowed more pains on this problem than any other in his whole work; and his investigation has pointed out almost all the improvements which have been made in the application of mathematical knowledge to the study of nature. Nowhere does his sagacity and fertility of resource appear in so strong a light as in the second book of the *Principia*, which is almost wholly occupied by this problem. The celebrated mathematician John Bernouilli engaged in it as the finest opportunity of displaying his superiority. A mistake committed by Newton in his attempt to a solution was matter of triumph to him; and the whole of his performance, though a piece of elegant and elaborate geometry, is greatly hurt by his continually bringing this mistake (which is a mere trifle) into view. The difficulty of the subject is so great, that subsequent mathematicians seem to have kept aloof from it; and it has been entirely overlooked by the many voluminous writers who have treated professedly on military projectiles. They have spoken indeed of the resistance of the air as affecting the flight of shot, but have saved themselves from the task of investigating this effect (a task to which they were unequal), by supposing that it was not so great as to render their theories and practical deductions very erroneous. Mr Robins was the first who seriously examined the subject. He showed, that even the Newtonian theory (which had been corrected, but not in the smallest degree improved or extended in its principles) was sufficient to show that the path of a cannon ball could not resemble a parabola. Even this theory showed that the resistance was more than eight times the weight of the ball, and should produce a greater deviation from the parabola than the parabola deviated from a straight line.

319 The ignorance of the writers on artillery in this respect.

This simple but singular observation was a strong proof how faulty the professed writers on artillery had been, in rather amusing themselves with elegant but useless applications of easy geometry, than in endeavouring to give their readers any useful information. He added, that the difference between the ranges by the Newtonian theory and by experiment was so great, that the resistance of the air must be vastly superior to what that theory supposed. It was this which suggested to him the necessity of experiments to ascertain this point. We have seen the result of these experiments in moderate velocities; and that they were sufficient for calling the whole theory in question, or at least for rendering it useless. It became necessary, therefore, to settle every point by means of a direct experiment. Here was a great difficulty. How shall we measure either of these great velocities which are observed in the motions of cannon-shot, or the resistances which these enormous velocities occasion? Mr Robins had the ingenuity to do both. The method which he took for measuring the velocity of a musket-ball was quite original; and it was susceptible of great accuracy. We have already given an account of it under the article GUNNERY. Having gained this point, the other was not difficult. In the moderate velocities he had determined the resistances by the forces which balanced them, the weights which kept the resisted body in a state of uniform motion. In the great velocities, he proposed to determine the resistances by their immediate effects, by the retardations which they occasioned. This was to be done by first ascertaining the velocity of the ball, and then measuring its velocity after it had passed through a certain quantity of air. The difference of these velocities is the retardation, and the proper measure of the resistance; for, by the initial and final velocities of the ball, we learn the time which was employed in passing through this air with the medium velocity. In this time the air's resistance diminished the velocity by a certain quantity. Compare this with the velocity which a body projected directly upwards would lose in the same time by the resistance of gravity. The two forces must be in the proportion of their effects. Thus we learn the proportion of the resistance of the air to the weight of the ball. It is indeed true, that the time of passing through this space is not accurately had by taking the arithmetical medium of the initial and final velocities, nor does the resistance deduced from this calculation accurately correspond to this mean velocity; but both may be accurately found by the experiment by a very troublesome computation, as is shown in the 5th and 6th propositions of the second book of Newton's *Principia*. The difference between the quantities thus found and those deduced from the simple process is quite trifling, and far within the limits of accuracy attainable in experiments of this kind; it may, therefore, be safely neglected.

320 Mr Robins made many experiments on this subject.

Mr Robins made many experiments on this subject; but unfortunately he has published only a very few, such as were sufficient for ascertaining the point he had in view. He intended a regular work on the subject, in which the gradual variations of resistance corresponding to different velocities should all be determined by experiment: but he was then newly engaged in an important and laborious employment, as chief engineer to the East India Company, in whose service he went out to India, where he died in less than two years. It is to be regretted that no person has prosecuted these experiments. It would be neither laborious nor difficult, and would add more to the improvement of artillery than any thing that has been done since Mr Robins's death, if we except the prosecution of his experiments on the initial velocities of cannon-shot by Dr Charles Hutton royal professor at the Woolwich Academy. It is to be hoped that this gentleman, after having with such effect and success extended Mr Robins's experiments on the initial velocities of musket-shot to cannon, will take up this other subject, and thus give the art of artillery all the scientific foundation which it can receive in the present state of our mathematical knowledge. Till then we must content ourselves with the practical rules which Robins has deduced from his own experiments. As he has not given us the mode of deduction, we must compare the results with

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with experiment. He has indeed given a very extensive comparison with the numerous experiments made both in Britain and on the continent; and the agreement is very great. His learned commentator Euler has been at no pains to investigate these rules, and has employed himself chiefly in detecting errors, most of which are supposed, because he takes for a finished work what Mr Robins only gives to the public as a hasty but useful sketch of a new and very difficult branch of science.

321 General result of them, &c.

The general result of Robins's experiments on the retardation of musket-shot is, that although in moderate velocities the resistance is so nearly in the duplicate proportion of the velocities that we cannot observe any deviation, yet in velocities exceeding 200 feet per second the retardations increase faster, and the deviation from this rate increases rapidly with the velocity. He ascribes this to the causes already mentioned, viz. the condensation of the air before the ball and to the rarefaction behind, in consequence of the air not immediately occupying the space left by the bullet. This increase is so great, that if the resistance to a ball moving with the velocity of 1700 feet in a second be computed on the supposition that the resistance observed in moderate velocities is increased in the duplicate ratio of the velocity, it will be found hardly one-third part of its real quantity. He found, for instance, that a ball moving through 1670 feet in a second lost about 125 feet per second of its velocity in passing through 50 feet of air. This it must have done in the $\frac{1}{32}$ of a second, in which time it would have lost one foot if projected directly upwards; from which it appears that the resistance was about 125 times its weight, and more than three times greater than if it had increased from the resistance in small velocities in the duplicate ratio of the velocities. He relates other experiments which show similar results.

But he also mentions a singular circumstance, that till the velocities exceed 1100 feet per second, the resistances increase pretty regularly, in a ratio exceeding the duplicate ratio of the velocities; but that in greater velocities the resistances become suddenly triple of what they would have been, even according to this law of increase. He thinks this explicable by the vacuum which is then left behind the ball, it being well known that air rushes into a vacuum with the velocity of 1132 feet per second nearly. Mr Euler controverts this conclusion, as inconsistent with that gradation which is observed in all the operations of nature; and says, that although the vacuum is not produced in smaller velocities than this, the air behind the ball must be so rare (the space being but imperfectly filled), that the pressure on the anterior part of the ball must gradually approximate to that pressure which an absolute vacuum would produce; but this is like his other criticisms. Robins does nowhere assert that this sudden change of resistance happens in the transition of the velocity from 1132 feet to that of 1131 feet 11 inches or the like, but only that it is very sudden and very great. It may be strictly demonstrated, that such a change must happen in a narrow enough limit of velocities to justify the appellation of sudden: a similar fact may be observed in the motion of a solid through water. If it be gradually accelerated, the water will be found nearly to fill up its place, till the velocity arrives at a certain magnitude, corresponding to the immersion of the body in the water; and then the smallest augmentation of its motion immediately produces a void behind it, into which the water rushes in a violent manner and is dashed into froth. A gentleman, who has had many opportunities for such observations, assures us, that when standing near the line of direction of a cannon discharging a ball with a large allotment of powder, so that the initial velocity certainly exceeded 1100 feet per second, he always observed a very sudden diminution of the noise which the bullet made during its passage. Although the ball was coming towards him, and therefore its noise, if equable, would be continually increasing, he observed that it was loudest at first. That this continued for a second or two, and suddenly diminished, changing to a sound which was not only weaker, but differed in kind, and gradually increased as the bullet approached him. He said, that the first noise was like the hissing of red-hot iron in water, and that the subsequent noise rather resembled a hazy whistling. Such a change of sound is a necessary consequence of the different agitation of the air in the two cases. We know also, that air rushing into a void, as when we break an exhausted bottle, makes a report like a musket.

322 Partly controverted by Euler, but without sufficient grounds.

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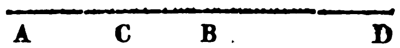
Mr Robins's assertion therefore has every argument for its truth that the nature of the thing will admit. But we are not left to this vague reasoning: his experiments show us this diminution of resistance. It clearly appears from them, that in a velocity of 1700 feet the resistance is more than three times the resistance determined by the theory which he supposes the common one. When the velocity was 1065 feet, the actual resistance was $\frac{11}{7}$ of the theoretical; and when the velocity was 400 feet, the actual resistance was about $\frac{4}{5}$ of the theoretical. That he assumed a theory of resistance which gave them all too small, is of no consequence in the present argument.

323 Rule by Robins for computing resistances and very rapid motions.

Mr Robins, in summing up the results of his observations on this subject, gives a rule very easily remembered for computing the resistances to those very rapid motions. It has been already mentioned in the article GUNNERY, but we repeat it here, in order to accommodate it to the quantities which have been determined in some degree by experiment.



Let AB represent the velocity of 1700 feet per second, and AC any other velocity. Make BD to AD as the resistance given by the ordinary theory to the resistance actually observed in the velocity 1700: then will CD be to AD as the resistance assigned by the ordinary theory to the velocity AC is to that which really corresponds to it.

To accommodate this to experiment, recollect* that a sphere of the size of a 12 pound iron shot, moving 25 feet in a second, had a resistance of $\frac{1}{22}$ of a pound. Augment this in the ratio of 25^2 to 1700^2, and we obtain 210 nearly for the theoretical resistance to this velocity; but by comparing its diameter of $4\frac{1}{2}$ inches with $\frac{3}{4}$, the diameter of the leaden ball, which had a resistance of at least 11 pounds with this velocity, we conclude that the 12 pound shot would have had a resistance of 396 pounds: therefore BD : AD $=$ 210 : 396, and AB : AD $=$ 186 : 396; and AB being 1700, AD will be 3613.

Let AD $= a$, AC $= x$, and let R be the resistance to a 12 pound iron shot moving one foot per second, and r the resistance (in pounds) wanted for the velocity x;

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* See Gunnery, N° 19. &c,

we have $r = R\frac{ax^2}{a-x}$. Mr Robins's experiments give $R = \frac{1}{13750}$ very nearly. This gives $Ra = 0,263235$, which is nearly one-fourth. Thus our formula becomes $r = \frac{0.263235\,x^2}{3613-x}$, or very nearly $\frac{x^2}{4(3613-x)}$, falling short of the truth about $\frac{1}{10}$th part. The simplicity of the formula recommends it to our use, and when we increase its result $\frac{1}{80}$, it is incomparably nearer to the true result of the theory as corrected by Mr Robins than we can hope that the theory is to the actual resistance. We can easily see that Mr Robins's correction is only a sagacious approximation. If we suppose the velocity 3613 feet, a very possible thing, the resistance by this formula is infinite, which cannot be. We may even suppose that the resistance given by the formula is near the truth only in such velocities as do not greatly exceed 1700 feet per second. No military projectile exceeds 2200, and it is great folly to make it so great, because it is reduced to 1700 almost in an instant, by the enormous resistance.

The resistance to other balls will be made by taking them in the duplicate ratio of the diameters.

324 The dicussions of mathematicians not easily applied.

It has been already observed, that the first mathematicians of Europe have lately employed themselves in improving this theory of the motion of bodies in a resisting medium; but their discussions are such as few artillerists can understand. The problem can only be solved by approximation, and this by the quadrature of very complicated curves. They have not been able therefore to deduce from them any practical rules of easy application, and have been obliged to compute tables suited to different cases.

325 Borda's and Robins's apparently the best.

Of these performances, that of the Chevalier Borda, in the Memoirs of the Academy of Sciences for 1769, seems the best adapted to military readers, and the tables are undoubtedly of considerably use; but it is not too much to say, that the simple rules of Mr Robins are of as much service, and are more easily remembered: besides, it must be observed, that the nature of military service does not give room for the application of any very precise rule. The only advantage that we can derive from a perfect theory would be an improvement in the construction of pieces of ordnance, and a more judicious appropriation of certain velocities to certain purposes. The service of a gun or mortar must always be regulated by the eye.

326 Undulation of air.

There is another motion of which air and other elastic fluids are susceptible, viz. an internal vibration of their particles, or undulation, by which any extended portion of air is distributed into alternate parcels of condensed and rarefied air, which are continually changing their condition without changing their places. By this change the condensation which is produced in one part of the air is gradually transferred along the mass of air to the greatest distances in all directions. It is of importance to have some distinct conception of this motion. It is found to be by this means that distant bodies produce in us the sensation of sound. See ACOUSTICS. Sir Isaac Newton treated this subject with his accustomed ingenuity, and has given us a theory of it in the end of the second book of his *Principia*. This theory has been objected to with respect to the conduct of the argument, and other explanations have been given by the most eminent mathematicians. Though they appear to differ from Newton's, their results are precisely the same; but, on a close examination, they differ no more than John Bernouilli's theorem of centripetal forces differs from Newton's, viz. the one being expressed by geometry and the other by literal analysis. The celebrated De la Grange reduces Newton's investigation to a tautological proposition or identical equation; but Mr Young of Trinity college, Dublin, has, by a different turn of expression, freed Newton's method from this objection. We shall not repeat it here, but refer our mathematical readers to the article ACOUSTICS, as it is not our business at present to consider its connexion with sound.

327 Has been used to explain a variety of natural phenomena

But since Newton published this theory of aerial undulations, and of their propagation along the air, and since the theory has been so corrected and improved as to be received by the most accurate philosophers as a branch of natural philosophy susceptible of rigid demonstration, it has been freely resorted to by many writers on other parts of natural science, who did not profess to be mathematicians, but made use of it for explaining phenomena in their own line on the authority of the mathematicians themselves. Learning from them that this vibration, and the *quaquaversum* propagation of the pulses, were the necessary properties of an elastic fluid, and that the rapidity of this propagation had a certain assignable proportion to the elasticity and density of the fluid, they freely made use of these concessions, and have introduced elastic vibrating fluids into many facts, where others would suspect no such thing, and have attempted to explain by their means many abstruse phenomena of nature. Æthers are everywhere introduced, endued with great elasticity and tenuity. Vibrations and pulses are supposed in this æther, and these are offered as explanations. The doctrines of animal spirits and nervous fluids, and the whole mechanical system of Hartley, by which the operations of the soul are said to be explained, have their foundation in this theory of aerial undulations. If these fancied fluids, and their internal vibrations, really operate in the phenomena ascribed to them, any explanation that can be given of the phenomena from this principle must be nothing else than showing that the legitimate consequences of these undulations are similar to the phenomena; or, if we are no more able to see this last step than in the case of sound (which we know to be *one* consequence of the aerial undulations, although we cannot tell how), we must be able to point out, as in the case of sound, certain constant relations between the general laws of these undulations and the general laws of the phenomena. It is only in this way that we think ourselves entitled to say that the aerial undulations are causes, though not the only causes, of sound; an it is because there is no such relation, but, on the contrary, a total dissimilarity, to be observed between the laws of elastic undulation and the laws of the propagation of light, that we assert with confidence that ethereal undulations are not the causes of vision.

328 But the application not being made with sufficient precision

Explanations of this kind suppose, therefore, in the first place, that the philosopher who proposes them understands precisely the nature of these undulations; in the next place, that he makes his reader sensible of those circumstances of them which are concerned in the effect to be explained; and, in the third place, that he makes the reader understand how this circumstance of the vibrating fluid is connected with the phenomenon, either by showing it to be its mechanical cause, as when the philosopher explains the resounding of a musical chord to a flute or pipe which gave the same tone; or by showing that this circumstance of the undulation always accompanies the phenomenon, as when the philosopher shows that 233 vibrations of air in a second, in whatever manner or by whatever cause they are produced, always are followed by the sensation of the tone C in the middle of the harpsichord.

But here we must observe, that, with the exception of Euler's unsuccessful attempt to explain the optical phenomena by the undulations of ether, we have met with no explanation of natural phenomena, by means of elastic and vibrating fluids, where the author has so much as attempted any one of these three things, so indispensably requisite in a logical explanation. They have talked of vibrations without describing them, or giving the reader the least notion of what kind they are; and in no instance that we can recollect have they showed how such vibrations could have any influence in the phenomenon. Indeed, by not describing with precision the undulations, they were freed from the task of showing them to be mechanical causes of the phenomenon; and when any of them show any analogy between the general laws of elastic undulations and the general laws of the phenomenon, the analogy is so vague, indistinct, or partial, that no person of common prudence would receive it as argument in any case in which he was much interested.

329 has become the foundation of materialism.

We think it our duty to remonstrate against this slovenly way of writing: we would even hold it up to reprobation. It has been chiefly on this faithless foundation that the blind vanity of men has raised that degrading system of opinions called MATERIALISM, by which the affections and faculties of the soul of man have been resolved into vibrations and pulses of ether.

330 Of the motion of elastic fluids.

We also think it our duty to give some account of this motion of elastic fluids. It must be such an account as shall be understood by those who are not mathematicians, because those only are in danger of being misled by the improper application of them. Mathematical discussion is, however, unavoidable in a subject purely mathematical; but we shall introduce nothing that may not be easily understood or confided in; and we trust that mathematical readers will excuse us for a mode of reasoning which appears to them lax and inelegant.

331 How they differ from unelastic fluids in propagating any agitation of their parts.

The first thing incumbent on us is to show how elastic fluids differ from the unelastic in the propagation of any agitation of the parts. When a long tube is filled with water, and any one part of it pushed out of its place, the whole is instantly moved like a solid mass. But this is not the case with air. If a door be suddenly shut, the window at the farther end of a long and close room will rattle; but some time will elapse between the shutting of the door and the motion of the window. If some light dust be lying on a braced drum, and another be violently beat at a little distance from it, an attentive observer will see the dust dance up from the parchment; but this will be at the instant he hears the sound of the stroke on the other drum, and a sensible time after the stroke. Many such familiar facts show that the agitation is gradually communicated along the air; and therefore that when one particle is agitated by any sensible motion, a finite time, however small, must elapse before the adjoining particle is agitated in the same manner. This would not be the case in water if water be perfectly incompressible. We think that this may be made intelligible with very little trouble.

Let A, B, C, D, &c. be a row of aerial particles, at such distances that their elasticity just balances the pressure of the atmosphere; and let us suppose (as is deducible from the observed density of air being proportional to the compressing force) that the elasticity of the particles, by which they keep each other at a distance, is as their distances inversely. Let us farther suppose that the particle A has been carried, with an uniform motion, to a by some external force. It is evident that B cannot remain in its present state; for being now nearer to a than to C, it is propelled towards C by the excess of the elasticity of A above the natural elasticity of C. Let E be the natural elasticity of the particles, or the force corresponding to the distance BC or BA, and let F be the force which impels B towards C, and let f be the force exerted by A when at a. We have

$$E : f = \mathrm{B}a : \mathrm{BC}, = \mathrm{B}a : \mathrm{BA};$$
$$\text{and } E : f - E = \mathrm{B}a : \mathrm{BA} - \mathrm{B}a = \mathrm{B}a : \mathrm{A}a;$$
$$\text{or } E : F = \mathrm{B}a : \mathrm{A}a.$$

Fig. 89.

Now in fig. 89. let ABC be the line joining three particles, to which draw FG, PH parallel, and IAF, HBG perpendicular. Take IF or HG to represent the elasticity corresponding to the distance AB. Let the particle A be supposed to have been carried with an uniform motion to a by some external force, and draw RaM perpendicular to RG, and make FI : RM = Ba : BA. We shall then have FI : PM = Ba : Aa; and PM will represent the force with which the particle B is urged towards C. Suppose this construction to be made for every point of the line AB, and that a point M is thus determined for each of them, mathematicians know that all these points M lie in the curve of a hyperbola, of which FG and GH are the asymptotes. It it is also known by the elements of mechanics, that since the motion of A along AB is uniform, Aa or IP may be taken to represent the time of describing Aa; and that the area IPM represents the whole velocity which B has acquired in its motion towards C when A has come to a, the force urging B being always as the portion PM of the ordinate.

Take GX of any length in HG produced, and let GX represent the velocity which the uniform action of the natural elasticity IF could communicate to the particle B during the time that A would uniformly describe AB. Make GX to GY as the rectangle IFGH to the hyperbolic space IFRM, and draw YS cutting MR produced in S, and draw FX cutting MR in T. It is known to the mathematicians that the point S is in a curve line FSs called the *logarithmic curve*; of which the leading property is, that any line RS parallel to GX is to GX as the rectangle IFGH is to the hyperbolic space IFRM, and that FX touches the curve in F.

This being the case, it is plain, that because RT increases in the same proportion with FR, or with the rectangle IFRP, and RS increases in the proportion of the space IFRM, TS increases in the proportion of the space IPM. Therefore TS is proportional to the velocity of B when A has reached *a*, and RT is proportional to the velocity which the uniform action of the natural elasticity would communicate to B in the same time. Then since FT is as the time, and TS is as the velocity, the area FTS will be as the space described by B (urged by the variable force PM); while A, urged by the external force, describes A *a;* and the triangle FRT will represent the space which the uniform action of the natural elasticity would cause B to describe in the same time.

And thus it is plain that these three motions can be compared together: the uniform motion of the agitated particle A, the uniformly accelerated motion which the natural elasticity would communicate to B by its constant action, and the motion produced in B by the agitation of A. But this comparison, requiring the quadrature of the hyperbola and logarithmic curve, would lead us into most intricate and tedious computations. Of these we need only give the result, and make some other comparisons which are palpable.

Let A *a* be supposed indefinitely small in comparison of AB. The space described by A is therefore indefinitely small; but in this case we know that the ratio of the space FRT to the rectangle IFRP is indefinitely small. There is therefore no comparison between the agitation of A by the external force, and the agitation which natural elasticity would produce on a single particle in the same time, the last being incomparably smaller than the first. And this space FRT is incomparably greater than FTS; and therefore the space which B would describe by the uniform action of the natural elasticity is incomparably greater than what it would describe in consequence of the agitation of A.

From this reasoning we see evidently that A must be sensibly moved, or a finite or measurable time must elapse before B acquires a measurable motion. In like manner B must move during a measurable time before C acquires a measurable motion, &c.; and therefore the agitation of A is communicated to the distant particles in gradual succession.

By a farther comparison of these spaces we learn the time in which each succeeding particle acquires the very agitation of A. If the particles B and C only are considered, and the motion of C neglected, it will be found that B has acquired the motion of A a little before it has described $\frac{1}{3}$ of the space described by A; but if the motion C be considered, the acceleration of B must be increased by the retreat of C, and B must describe a greater space in proportion to that described by A. By computation it appears, that when both B and C have acquired the velocity of A, B has described nearly $\frac{1}{2}$ of A's motion, and C more nearly $\frac{1}{3}$. Extending this to D, we shall find that D has described still more nearly $\frac{1}{4}$ of A's motion. And from the nature of the computation it appears that this approximation goes on rapidly: therefore, supposing it accurate from the very first particle, it follows from the equable motion of A, that each succeeding particle moves through an equal space in acquiring the motion of A.

The conclusion which we must draw from all this is, that when the agitation of A has been fully communicated to a particle at a *sensible* distance, the intervening particles all moving forward with a common velocity, are equally compressed as to sense, except a very few of the first particles; and that this communication, or this propagation of the original agitation, goes on with an uniform velocity.

These computations need not be attended to by such as do not wish for an accurate knowledge of the precise agitation of each particle. It is enough for such readers to see clearly that time *must* escape between the agitation of A and that of a distant particle; and this is abundantly manifest from the incomparability (excuse the term) of the nascent rectangle IFRP with the nascent triangle FRT, and the incomparability of FRT with FTS.

331 Newton's demonstration on this subject just as far as it goes;

What has now been shown of the communication of any sensible motion A *a* must hold equally with respect to any change of this motion. Therefore if a tremulous motion of a body, such as a spring or bell, should agitate the adjoining particle A by pushing it forward in the direction AB, and then allowing it to come back again in the direction BA, an agitation similar to this will take place in all the particles of the row one after the other. Now if this body vibrate according to the law of motion of a pendulum vibrating in a cycloid, the neighbouring particle of air *will of necessity* vibrate in the same manner; and then Newton's demonstration in art. ACOUSTICS needs no apology. Its only deficiency was, that it *seemed* to prove that this *would be* the way in which every particle would of necessity vibrate; which is not true, for the successive parcels of air will be differently agitated according to the original agitation. Newton only wants to prove the uniform propagation of the agitations, and he selects that form which renders the proof easiest. He proves, in the most unexceptionable manner, that if the particles of a pulse of air are really moving like a cycloidal pendulum, the forces acting on each particle, in consequence of the compression and dilatation of the different parts of the pulse, are precisely such as are necessary for continuing this motion, and therefore no other forces are required. Then since each particle is in a certain part of its path, is moving in a certain direction and with a certain velocity, and urged by a determined force, it *must* move in that very manner. The objection started by John Bernouilli against Newton's demonstration (in a single line) of the elliptical motion of a body urged by a force in the inverse duplicate ratio of the distance from the focus, is precisely the same with the objection against Newton's demonstration of the progress of aerial undulations, and is equally futile.

It must, however, be observed, that Newton's demonstration proceeds on the supposition that the linear agitations of a particle are incomparably smaller than the extent of an undulation. This is not strictly the case in any instance, and in many it is far from being true. In a pretty strong twang of a harpsichord wire, the agitation of a particle may be near the 50th part of the extent of the undulation. This must disturb the regularity of the motion, and cause the agitations in the remote undulations to differ from those in the first pulse. In the explosion of a cannon, the breaking of an exhausted bottle, and many instances which may be given, the agitations are still greater. The commentators on Newton's *Principia*, Le Sueur and Jacquier, have shown, and Euler more clearly, that when the original agitations are very violent, the particles of air will acquire a subordinate vibration compounded with the regular cycloidal vibration, and the progress of the pulses will be somewhat more rapid; but the intricacy of the calculus is so great, that they have not been able to determine with any tolerable precision what the change of velocity will be.

333 it is strengthened by comparing the sound of a cannon near and at a distance.

All this, however, is fully confirmed by experiment on sounds. The sound of a cannon at 10 or 20 miles distance does not in the least resemble its sound when near. In this case it is a loud instantaneous crack, to which we can assign no musical pitch: at a distance, it is a grave sound, of which we can tell the note; and it begins softly, swells to its greatest loudness, and then dies away growling. The same may be said of a clap of thunder, which we know to be a loud snap of still less duration. It is highly probable that the appreciable tones which those distant sounds afford are produced by the continuance of these subordinate vibrations which are added together and fortified in the successive pulses, though not perceptible in the first, in a way somewhat resembling the resonance of a musical chord. Newton's explanation gathers evidence therefore from this circumstance. And we must further observe, that all elastic bodies tremble or vibrate almost precisely as a pendulum swinging in a cycloid, unless their vibrations are uncommonly violent; in which case they are quickly reduced to a moderate quantity by the resistance of the air. The only very loud sounds which we can produce in this way are from great bells; and in these the utmost extent of the vibration is very small in comparison with the breadth of the pulse. The velocity of these sounds has not been compared with that of cannon, or perhaps it would be found less, and an objection against Newton's determination removed. He gives 969 feet per second, Experiment 1142.

334 The agitation in all probability in the successive pulses assumes a cycloidal form.

But it is also very probable, that in the propagation through the air, the agitation gradually and rapidly approaches to this regular cycloidal form in the successive pulses, in the same way as we observe that whatever is the form of agitation in the middle of a smooth pond of water, the spreading circles are always of one gentle form without asperities. In like manner, into whatever form we throw a stretched cord by the twang which we give it, it almost immediately makes smooth undulations, keeping itself in the shape of an elongated trochoid. Of this last we can demonstrate the necessity, because the case is simple. In the wave, the investigation is next to impossible; but we see the fact. We may therefore presume it in air. And accordingly we know that any noise, however abrupt and jarring, near at hand, is smooth at a distance. Nothing is more rough and harsh than the scream of a heron; but at half a mile's distance it is soft. The ruffle of a drum is also smooth at a distance.

Plate ccccxxxii. fig. 90.

Fig. 90. shows the successive situations of the particles of a row. Each line of the figure shows the same particles marked with the same letters; the first particle *a* being supposed to be removed successively from its quiescent situation and back to it again. The mark × is put on that part of each line where the agitated particles are at their natural distances, and the air is of the natural density. The mark 1 is put where the air is most of all compressed, and : where it is most of all dilated; the curve line drawn through the lowest line of the figure is intended to represent the density in every point, by drawing ordinates to it from the straight line: the ordinates below the line indicate a rarity, and those above the line a density, greater than common.

It appears that when *a* has come back to its natural situation, the part of greatest density is between the particles *i* and *k*, and the greatest rarity between *c* and *d*.

We have only to add, that the velocity of this propagation depends on the elasticity and density of the fluid. If these vary in the same proportion, that is, if the fluid has its elasticity proportional to its density, the velocity will remain the same. If the elasticity or density alone be changed, the velocity of the undulations will change in the direct subduplicate ratio of the elasticity and the inverse subduplicate ratio of the density; for should the elasticity be quadrupled, the quantity of motion produced by it in any given time will be quadrupled. This will be the case if the velocity be doubled; for there would then be double the number of particles doubly agitated. Should the density be quadrupled, the elasticity remaining the same, the quantity of motion must remain the same. This will be the case if the velocity be reduced to one half; for this will propagate half the agitation to half the distance, which will communicate it to twice the number of particles, and the quantity of motion will remain the same. The same may be said of other proportions, and therefore $V=\frac{\sqrt{E}}{\sqrt{D}}$. Therefore a change in the barometer will not affect the velocity of the undulations in air; but they will be accelerated by heat, which diminishes its density, or increases its elasticity. The velocity of the pulses in inflammable air must be at least thrice as great, because its density is but one-tenth of that of air when the elasticity of both are the same.

335 Further consideration of aerial pulses as they really occur.

Let us now attend a little to the propagation of aerial pulses as they really happen; for this hypothesis of a single row of particles is nowhere to be observed.

Fig. 91.

Suppose a sphere A, fig. 91. filled with condensed air, and that the vessel which contains it is suddenly annihilated. The air must expand to its natural dimensions, suppose BCD. But it cannot do this without pressing aside the surrounding air. We have seen that in any single row of particles this cannot be at once diffused to a distance, but must produce a condensation in the air adjoining; which will be gradually propagated to a distance. Therefore this sphere BCD of the common density will form round it a shell, bounded by EFG, of condensed air. Suppose that at this instant the inner air BCD becomes solid. The shell of condensed air can expand only outwards. Let it expand till it is of the common density, occupying the shell HIK. This expansion, in like manner, must produce a shell of condensed air without it: at this instant let HIK become solid. The surrounding shell of condensed air can expand only outward, condensing another shell without it. It is plain that this must go on continually, and the central agitation will be gradually propagated to a distance in all directions. But, in this process, it is not the same numerical particles that go to a distance. Those of the original sphere go no further than BCD, those of the next shall go no further than HIK, &c. Farther, the expansion outwards of any particle will be more moderate as the diffusion advances; for the whole motion of each shell cannot exceed the original quantity of motion; and the number of particles in each successive shell increases as the surface, that is, as the square of the distance from the centre; therefore the agitation of the particles will decrease in the same ratio, or will be in the inverse duplicate ratio of the distance from the centre. Each successive shell, therefore, contains the same quantity of motion, and the successive agitations of the particles of any row out from the centre will not be equal to the original agitation, as happens in the solitary row. But this does not affect the velocity of the propagation, because all agitations are propagated equally fast.

We supposed the air A to become solid as soon as it acquired the common density; but this was to facilitate the conception of the diffusion. It does not stop at this bulk; for while it was denser it had a tendency to expand. Therefore each particle has attained this distance with an accelerated motion. It will, therefore, continue this motion like a pendulum that has passed the perpendicular, till it is brought to rest by the air without it; and it is now rarer than common air, and collapses again by the greater elasticity of the air without it. This outward air, therefore, in regaining its natural density, must expand both ways. It expands towards the centre, following the collapsing of the air within it; and it expands outwards, condensing the air beyond it. By expanding inwards, it will again condense the air within it, and this will again expand; a similar motion happens in all the outward shells; and thus there is propagated a succession of condensed and rarefied shells of air, which gradually swell to the greatest distance.

336 Application of the fact of dropping a pebble into water.

It may be demonstrated, that when the central air has for the second time acquired the natural density, it will be at rest, and be disturbed no more; and that this will happen to all the shells in succession. But the demonstration is much too intricate for this place; we must be contented with pointing out a fact perfectly analogous. When we drop a small pebble into water, we see it produce a series of circular waves, which go along the surface of smooth water to a great distance, becoming more and more gentle as they recede from the centre; and the middle, where the agitation was first produced, remains perfectly smooth, and this smoothness extends continually; that is, each wave when brought to a level remains at rest. Now these waves are produced and propagated by the depression and elevation made at the centre. The elevation tends to diffuse itself; and the force with which each particle of water is actuated is a force acting directly up and down, and is proportional to the elevation or depression of the particle. This hydrostatical pressure operates precisely in the same way as the condensation and rarefaction of the air; and the mathematical investigation of the propagation of the circular undulations on smooth water is similar in every step to that of the propagation of the spherical waves in still air. For this we appeal to Newton's *Principia*, or to Euler's *Opuscula*, where he gives a very beautiful investigation of the velocity of the aerial pulses; and to some memoirs of de la Grange in the collections of the academies of Berlin and Turin. These two last authors have made the investigation as simple as seems possible, and have freed it from every objection which can be stated against the geometrical one of their great teacher Newton.

337 The waves of water are useful for explaining those of air.

Having said this much on the similarity between the waves on water and the aerial undulations, we shall have recourse to them, as affording us a very sensible object to represent many affections of the other which it would be extremely difficult to explain. We neither see nor feel the aerial undulations; and they behoved, therefore, to be described very abstractedly and imperfectly. In the watery wave there is no permanent progressive motion of the water from the centre. Throw a small bit of cork on the surface, and it will be observed to popple up and down without the least motion outwards. In like manner, the particles of air are only agitated a very little outwards and inwards; which motion is communicated to the particles beyond them, while they themselves come to rest, unless agitated afresh; and this agitation of the particles is inconceivably small. Even the explosion of a cannon at no great distance will but gently agitate a feather, giving it a single impulse outwards, and immediately after another inwards or towards the cannon. When a harpsichord wire is forcibly twanged at a few feet distance, the agitation of the air is next to insensible. It is not, however, nothing; and it differs from that in a watery wave by being *really* outwards and inwards. In consequence of this, when the condensed shell reaches an elastic body, it impels it slightly. If its elasticity be such as to make it acquire the opposite shape at the instant that the next agitation and condensed shell of air touches it, its agitation will be doubled, and a third agitation will increase it, and so on, till it acquire the agitation competent to that of the shell of air which reaches it, and it is thrown into *sensible* vibration, and gives a sound extremely faint indeed, because the agitation which it acquires is that corresponding to a shell of air considerably removed from the original string. Hence it happens that a musical chord, pipe, or bell, will cause another to resound, whose vibrations are isochronous with its own; or if the vibrations of the one coincides with every second, or third, or fourth, &c. of the other; just as we can put a very heavy pendulum into sensible motion by giving it a gentle puff with the breath at every vibration, or at every second, third, or fourth, &c. A drum struck in the neighbourhood of another drum will agitate it *very sensibly*; for here the stroke depresses a very considerable surface, and produces an agitation of a considerable mass of air: it will even agitate the surface of stagnant water. The explosion of a cannon will even break a neighbouring window. The shell of condensed air which comes against the glass has a great surface and a great agitation: the best security in this case is to throw up the sash; this admits the condensed air into the room, which acts on the inside of the window, balancing part of the external impulse.

338 For waves of air and of water are in many respects very similar.

It is demonstrated in every elementary treatise of natural philosophy, that when a wave on water meets any plane obstacle, it is reflected by it from a centre equally removed behind the obstacle; that waves radiating from the focus of a parabola are reflected in waves perpendicular to its axis; that waves radiating from one focus of an ellipse are made to converge to the other focus, &c. &c. All this may be affirmed of the aerial undulations; that when part of a wave gets through a hole in the obstacle, it becomes the centre of a new series of waves; that waves bend round the extremities of an obstacle: all this happens in the aerial undulations. And lastly, that when the surface of water is thrown into regular undulations by one agitation, another agitation in another place will produce other regular waves, which will cross the former without disturbing them in the smallest degree. The same thing happens in air; and experiments may be made on water which will illustrate in the most perfect manner many other affections of the aerial pulses, which we should otherwise conceive very imperfectly. We would recommend to our curious readers to make some of these experiments in a large vessel of milk. Take a long and narrow plate of lead, which, when set on the bottom of the vessel, will reach above the surface of the milk; bend this plate into a parabola, elliptical or other curve. Make the undulations by dropping milk on the focus from a small pipe, which will cause the agitations to succeed with rapidity, and then all that we have said will be most distinctly seen, and the experiment will be very amusing and instructive, especially to the musical reader.

339 **Caution to the supporters of æthers, animal spirits, &c.**

We would now request all who make or read explanations of natural phenomena by means of vibrations of æthers, animal spirits, nervous fluids, &c. to fix their attention on the nature of the agitation in one of these undulations. Let him consider whether this can produce the phenomenon, acting as any matter must act, by impulse or by pressure. If he sees that it can produce the phenomenon, he will be able to point out the very motion it will produce, both in quantity and direction, in the same manner as Sir Isaac Newton has pointed out all the irregularities of the moon's motion produced by the disturbing force of the sun. If he cannot do this, he fails in giving the first evidence of a mechanical explanation by the action of an elastic vibrating fluid. Let him then try to point out some palpable connection between the general phenomena of elastic undulations and the phenomena in question; this would show an accompaniment to have at least some probability. It is thus only we learn that the undulations of air produce sound: we cannot tell how they affect the mechanism of the ear; but we see that the phenomena of sound always accompany them, and that certain modifications of the one are regularly accompanied by certain modifications of the other. If we cannot do this neither, we have derived neither explanation nor illustration from the elastic fluid. And lastly, let him remember that even if he should be able to show the competency of this fluid to the production of the phenomenon, the whole is still an hypothesis, because we do not know that such a fluid exists.

340 **The folly of appealing to such unknown substances.**

We will venture to say, that whoever will proceed in this prudent manner will soon see the futility of most of the explanations of this kind which have been given. They are unfit for any but consummate mathematicians; for they alone really understand the mechanism of aerial undulations, and even they speak of them with hesitation as a thing but imperfectly understood. But even the unlearned in this science can see the incompatibility of the hypotheses with many things which they are brought to explain. To take an instance of the conveyance of sensation along the nerves; an elastic fluid is supposed to occupy them, and the undulations of this fluid are thought to be propagated along the nerves. Let us just think a little how the undulations would be conveyed along the surface of a canal which was completely filled up with reeds and bulrushes, or let us make the experiment on such a canal: we may rest assured that the undulations in the one case will resemble those in the other; and we may see that in the canal there will be no regular or sensible propagation of the waves.

Let these observations have their influence, along with others which we have made on other occasions, to wean our readers from this fashionable proneness to introduce invisible fluids and unknown vibrations into our physical discussions. They have done immense, and we fear irreparable, mischief in science; and there is but one phenomenon that has ever received any explanation by their means.

This may suffice for a loose and popular account of aerial undulations; and with it we conclude our account of the motion, impulse, and resistance of air.

We shall now explain a number of natural appearances, depending on its pressure and elasticity, appearances not sufficiently general, or too complicated for the purposes of argument, while we were employed in the investigation of these properties, but too important to be passed over in silence.

341 **The air's pressure occasions the cohesion of two surfaces accurately fitting each other;**

It is owing to the pressure of the atmosphere that two surfaces which accurately fit each other cohere with such force. This is a fact familiarly known to the glass-grinders, polishers of marble, &c. A large lense or speculum, ground on its tool till it becomes very smooth, requires more than any man's strength to separate it directly from the tool. If the surface is only a square inch, it will require 15 pounds to separate them perpendicularly, though a very moderate force will make them slide along each other. But this cohesion is not observed unless the surfaces are wetted or smeared with oil or grease; otherwise the air gets between them, and they separate without any trouble. That this cohesion is owing to the atmospheric pressure, is evident from the ease with which the plates may be separated in an exhausted receiver.

342 **and the adhesion of snails, &c. to rocks.**

To the same cause we must ascribe the very strong adhesion of snails, periwinkles, limpets, and other univalve shells, to the rocks. The animal forms the rim of its shell, so as to fit the shape of the rock to which it intends to cling. It then fills its shell (if not already filled by its own body) with water. In this condition it is evident that we must act with a force equal to 15 pounds for every square inch of touching surface before we can detach it. This may be illustrated by filling a drinking glass to the brim with water; and having covered it with a piece of thin wet leather, whelm it on a table, and then try to pull it straight up; it will require a considerable force. But if we expose a snail adhering to a stone in the exhausted receiver, we shall see it drop off by its own weight. In the same manner do the remora, the polypus, the lamprey, and many other animals, adhere with such firmness. Boys frequently amuse themselves by pulling out large stones from the pavement by means of a circle of stiff wetted leather fastened to a string. It is owing to the same cause that the bivalve shell fishes keep themselves so firmly shut. We think the muscular force of an oyster prodigious, because it requires such force to open it; but if we grind off a bit of the convex shell, so as to make a hole in it, though without hurting the fish in the smallest

est degree, it opens with great ease, as it does also *in vacuo*.

343 Other effects of the air's pressure.

The pressure of the air, operating in this way, contributes much to the cohesion of bodies, where we do not suspect its influence. The tenacity of our mortars and cements would frequently be ineffectual without this assistance.

It is owing to the pressure of the atmosphere that a cask will not run by the cock unless a hole be opened in some other part of the cask. If the cask is not quite full, some liquor indeed will run out, but it will stop as soon as the diminished elasticity of the air above the liquor is in equilibrio (together with the liquor) with the atmospheric pressure. In like manner, a teapot must have a small hole in its lid to ensure its pouring out the tea. If indeed the hole in the cask is of large dimensions, it will run without any other hole, because air will get in at the upper side of the hole while the liquor runs out by the lower part of it.

Plate ccccxxxi. fig. 74.

On the same principle depends the performance of an instrument used by the spirit dealers for taking out a sample of their spirits. It consists of a long tinplate tube AB (fig. 74.), open a-top at A, and ending in a small hole at B. The end B is dipped into the spirits, which rises into the tube; then the thumb is clapt on the mouth A, and the whole is lifted out of the cask. The spirit remains in it till the thumb be taken off; it is then allowed to run into a glass for examination.

344 Why frosts instantly occasion a scarcity of water.

It seems principally owing to the pressure of the air that frosts immediately occasion a scantiness of water in our fountains and wells. This is erroneously accounted for, by supposing that the water freezes in the bowels of the earth. But this is a great mistake: the most intense frost of a Siberian winter would not freeze the ground two feet deep; but a very moderate frost will consolidate the whole surface of a country, and make it impervious to the air; especially if the frost has been preceded by rain, which has soaked the surface. When this happens, the water which was filtering through the ground is all arrested and kept suspended in its capillary tubes by the pressure of the air, in the very same manner as the spirits are kept suspended in the instrument just now described by the thumb's shutting the hole A. A thaw melts the superficial ice, and allows the water to run in the same manner as the spirits run when the thumb is removed.

345 The necessity of common air to animal life.

Common air is necessary for supporting the lives of most animals. If a small animal, such as a mouse or bird, be put under the receiver of an air-pump, and the air be exhausted, the animal will quickly be thrown into convulsions and fall down dead; if the air be immediately readmitted, the animal will sometimes revive, especially if the rarefaction has been briskly made, and has not been very great. We do not know that any breathing animal can bear the air to be reduced to one-fourth of its ordinary density, nor even one-third; nor have we good evidence that an animal will ever recover if the rarefaction is pushed very far, although continued for a very short time.

But the mere presence of the air is by no means sufficient for preserving the life of the animal; for it is found, that an animal shut up in a vessel of air cannot live in it for any length of time. If a man be shut up in a box, containing a wine hogshead of air, he cannot live in it much above an hour, and long before this he will find his breathing very unsatisfactory and uneasy. A gallon of air will support him about a minute. A box EF (fig. 75.) may be made, having a pipe AB inserted into its top, and fitted with a very light valve at B, opening upwards. This pipe sends off a lateral branch *a* D *d* C, which enters the box at the bottom, and is also fitted with a light valve at C opening upwards. If a person breathe through the pipe, keeping his nostrils shut, it is evident that the air which he expires will not enter the box by the hole B, nor return through the pipe CD *d;* and by this contrivance he will gradually employ the whole air of the box. With this apparatus experiments can be made without any risk or inconveniency, and the quantity of air necessary for a given time of easy breathing may be accurately ascertained.

Fig. 75.

How the air of our atmosphere produces this effect, is a question which does not belong to mechanical philosophy to investigate or determine. We can, however affirm, that it is neither the pressure nor the elasticity of the air which is immediately concerned in maintaining the animal functions. We know that we can live and breathe with perfect freedom on the tops of the highest mountains. The valley of Quito in Peru, and the country round Gondar in Abyssinia, are so far elevated above the surface of the ocean, that the pressure and the elasticity of the air are one-third less than in the low countries; yet these are populous and healthy places. And, on the other hand, we know, that when an animal has breathed in any quantity of air for a certain time without renewal, it will not only be suffocated, but another animal put into this air will die immediately; and we do not find either the pressure or elasticity of the air remarkably diminished: it is indeed diminished, but by a very small quantity. Restoring the former pressure and elasticity has not the smallest tendency to prevent the death of the animal: for an animal will live no longer under a receiver that has its mouth inverted on water, than in one set upon the pump-plate covered with leather. Now when the receiver is set on water, the pressure of the atmosphere acts completely on the included air, and preserves it in the same state of elasticity.

346 The state of air which has maintained animal functions is quite altered.

In short, it is known that the air which has already served to maintain the animal functions has its chemical and alimentary properties completely changed, and is no longer fit for this purpose. So much of any mass of air as has really been thus employed is changed into what is called *fixed air* by Dr Black, or *carbonic acid* by the chemists of the Lavoisierian school. Any person may be convinced of this by breathing or blowing through a pipe immersed in lime water. Every expiration will produce white clouds on the water, till all the lime which it contains is precipitated in the form of pure chalk. In this case we know that the lime has combined with the fixed air.

347 Hales's experiments to restore its former qualities, &c.

The celebrated Dr Stephen Hales made many experiments, with a view to clear the air from the noxious vapour which he supposed to be emitted from the lungs.

He made use of the apparatus which we have been just now mentioning; and he put several diaphragms *ff*, *ff*, &c. of thin woollen stuff into the box, and moistened them with various liquids. He found nothing so efficacious as a solution of potash. We now understand

stand this perfectly. If the solution is not already saturated with fixed air, it will take it up as fast as it is produced, and thus will purify the air: a solution of caustic alkali therefore will have this effect till it is rendered quite mild.

348 ow it mes to changed breathing, and e nature inspiration, &c.

These experiments have been repeated, and varied in many circumstances, in order to ascertain whether this fixed air was really emitted by the lungs, or whether the inspired air was in part changed into fixed air by its combination with some other substance. This is a question which comes properly in our way, and which the doctrines of pneumatics enable us to answer. If the fixed air be emitted in substance from the lungs, it does not appear how a renewal of the air into which it is emitted is necessary: for this does not hinder the subsequent emission; and the bulk of the air would be increased by breathing in it, viz. by the bulk of all the fixed air emitted; but, on the contrary, it is a little diminished. We must therefore adopt the other opinion; and the discoveries in modern chemistry enable us to give a pretty accurate account of the whole process. Fixed air is acknowledged to be a compound, of which one ingredient is found to constitute about three-eighths of the whole atmospheric fluid; we mean vital air or the oxygen of Lavoisier. When this is combined with phlogiston, according to the doctrine of Stahl, or with charcoal, according to Lavoisier, the result is fixed air or carbonic acid. The change therefore which breathing makes on the air is the solution of this matter by vital air; and the use of air in breathing is the carrying off this noxious principle in the way of solution. When therefore the air is already so far saturated as not to dissolve this substance as fast as it is secreted, or must be secreted in the lungs, the animal suffers the pain of suffocation, or is otherwise mortally affected. Suffocation is not the only consequence; for we can remain for a number of seconds without breathing, and then we begin to feel the true pain of suffocation; but those who have been instantaneously struck down by an inspiration of fixed air, and afterwards recovered to life, complained of no such pain, and seemed to have suffered chiefly by a nervous affection. It is said (but we will not vouch for the truth of it, that a person may safely take a full inspiration of fixed air, if the passages of the nose be shut; and that unless these nerves are stimulated by the fixed air, it is not instantaneously mortal. But these are questions out of our present line of inquiry. They are questions of physiology, and are treated of in other places of this work. See ANATOMY and PHYSIOLOGY; see also LUNGS and RESPIRATION. Our business is to explain in what manner the pressure and elasticity of the air, combined with the structure and mechanism of the body, operate in producing this necessary secretion and removal of the matter discharged from the lungs in the act of breathing.

It is well ascertained, that the secretion is made from the mass of blood during its passage through the lungs. The blood delivered into the lungs is of a dark blackish colour, and is there changed into a florid red. In the lungs it is exposed to the action of the air in a prodigiously extended surface: for the lungs consist of an inconceivable number of small vessels or bladders, communicating with each other and with the windpipe. These are filled with air in every inspiration. These vessels are every where in contact with minute blood-vessels. The blood does not *in toto* come into immediate contact with the air; and it would seem that it is only the thin serous part of it which is acted on by the air at the mouths of the vessels or pores, where it stands by capillary attraction. Dr Priestley found, that venous blood, inclosed in thin bladders and other membranes, was rendered florid by keeping the bladders in contact with abundance of pure vital air. We know also, that breath is moist or damp, and *must* have acquired this moisture in the lungs. It is immaterial whether this secretion of water or lymph (as the anatomists call it) be furnished by mere exudation through simple pores, or by a vascular and organic secretion; in either case, some ingredient of the blood comes in contact with air in the lungs, and there unites with it. This is farther confirmed, by observing, that all breathing animals are warmer than the surrounding medium, and that by every process in which fixed air is formed from vital air heat is produced. Hence this solution in air of something from the blood has been assigned by many as the source of animal heat. We touch on these things in a very transitory way in this place, only in order to prove that, for the support of animal life, there must be a very extensive application of air to the blood, and that this is made in the lungs.

The question before us in this place is, How is this brought about by the weight and elasticity of the air? This is done in two ways; by the action of the muscles of the ribs, and by the action of the diaphragm and other muscles of the abdomen. The thorax or chest is a great cavity, completely filled by the lungs. The sides of this cavity are formed by the ribs. These are crooked or arched, and each is moveable round its two ends, one of them being inserted into the vertebræ of the back, and the other into the sternum or breast-bone. The rib turns in a manner resembling the handle of a drawer. The inspection of fig. 76. will illustrate this matter a little. Suppose the curves *a c e*, *b k f*, *c l g*, &c. to represent the ribs moveable round the extremities. Each succeeding rib is more bent than the one above it, and this curvature is both in the vertical and horizontal direction. Suppose each so broad as to project a little over its inferior like the tiles of a roof. It is evident, that if we take the lower one by its middle, and draw it out a little, moving it round the line *n p*, it will bring out the next *d m h* along with it. Also, because the distance of the middle point *o* from the axis of motion *n p* is greater than the distance of *m* from the axis *d h*, and because *o* will therefore describe a portion of a larger circle than *m* does, the rib *n o p* will slide up a little under the rib *d m h*, or the rib *d m h* will overlap *n o p* a little more than before; the distance *o m* will therefore be diminished. The same must happen to all the superior ribs; but the change of distance will be less and less as we go upwards. Now, instead of this great breadth of the ribs overlapping each other, suppose each inferior rib connected with the one above it by threads or fibres susceptible of contraction at the will of man. The articulations *e*, *a*, of the first or upper rib with the spine and sternum are so broad and firm, that this rib can have little or no motion round the line *a e*; this rib therefore is as a fixture for the ends of all the contracting fibres; therefore, whenever the fibres which connect the second rib with the first rib contract, the second must rise a little, and also go outward, and will carry the lower

Fig. 76.

ribs along with it; the third rib will rise still farther by the contraction of the muscles which connect it with the second, and so on: and thus the whole ribs are raised and thrown outward (and a little forward, because the articulation of each with the spine is considerably higher than that with the sternum), and the capacity of the thorax is enlarged by the contraction of its muscular covering. The direction of the muscular fibres is very oblique to the direction of the circular motion which it produces; from which circumstance it follows, that a very minute contraction of the muscles produces all the motion which is necessary. This indeed is not great; the whole motion of the lowest ribs is less than an inch in the most violent inspiration, and the whole contraction of the muscles of the twelve ribs does not exceed the eighth part of an inch, even supposing the intercostal muscles at right angles to the ribs; and being oblique, the contraction is still less (see Borelli, Sabatier, Monro, &c.). It would seem, that the intensity of the contractive power of a muscular fibre is easily obtained, but that the space through which it can be exerted is very limited; for in most cases nature places the muscles in situations of great mechanical disadvantage in this respect, in order to procure other conveniences.

But this is not the whole effect of the contraction of the intercostal muscles: since the compound action of the two sets of muscles, which cross each other from rib to rib like the letter X, is nearly at right angles to the rib, but is oblique to its plane, it tends to push the ribs closer on their articulations. and thus to press out the two pillars on which they are articulated. Thus, supposing *af* (fig. 77.) to represent the section of one of the vertebræ of the spine, and *c d* a section of the sternum, and *a b c*, *f e d*, two opposite ribs, with a lax thread *b e* connecting them. If this thread be pulled upwards by the middle *g* till it is tight, it will tend to pull the points *b* and *e* nearer to each other, and to press the vertebra *af* and the sternum *c d* outwards. The spine being the chief pillar of the body, may be considered as immoveable in the present instance. The sternum is sufficiently susceptible of motion for the present purpose. It remains almost fixed a-top at its articulation with the first rib, but it gradually yields below; and thus the capacity of the thorax is enlarged in this direction also. The whole enlargement of the diameters of the thorax during inspiration is very small, not exceeding the fiftieth part of an inch in ordinary cases. This is easily calculated. Its quiescent capacity is about two cubic feet, and we never draw in more than 15 inches. Two spheres, one of which holds 2 cubic feet and the other 2 feet and 15 inches, will not differ in diameter above the fiftieth part of an inch.

Fig. 77.

The other method of enlarging the capacity of the thorax is very different. It is separated from the abdomen by a strong muscular partition called the *diaphragm*, which is attached to firm parts all around. In its quiescent or relaxed state it is considerably convex upwards, that is, towards the thorax, rising up into its cavity like the bottom of an ordinary quart bottle, only not so regular in its shape. Many of its fibres tend from its middle to the circumference, where they are inserted into firm parts of the body. Now suppose these fibres to contract. This must draw down its middle, or make it flatter than before, and thus enlarge the capacity of the thorax.

Physiologists are not well agreed as to the share which each of these actions has in the operation of enlarging the thorax. Many refuse all share of it to the intercostal muscles, and say that it is performed by the diaphragm alone. But the fact is, that the ribs are really observed to rise even while the person is asleep; and this cannot possibly be produced by the diaphragm, as these anatomists assert. Such an opinion shows either ignorance or neglect of the laws of pneumatics. If the capacity of the thorax were enlarged only by drawing down the diaphragm, the pressure of the air would compress the ribs, and make them descend. And the simple laws of mechanics make it as evident as any proposition in geometry, that the contraction of the intercostal muscles *must* produce an elevation of the ribs and enlargement of the thorax; and it is one of the most beautiful contrivances of nature. It depends much on the will of the animal what share each of these actions shall have. In general, the greatest part is done by the diaphragm; and any person can breathe in such a manner that his rib shall remain motionless; and, on the contrary, he can breathe almost entirely by raising his chest. In the first method of breathing, the belly rises during inspiration, because the contraction of the diaphragm compresses the upper part of the bowels, and therefore squeezes them outwards; so that an ignorant person would be apt to think that the breathing was performed by the belly, and that the belly is inflated with the air. The strait lacing of the women impedes the motion of the ribs, and changes the natural habit of breathing, or brings on an unnatural habit. When the mind is depressed, it is observed that the breathing is more performed by the muscles of the thorax; and a deep sigh is always made in this way.

These observations on the manner in which the capacity of the chest can be enlarged were necessary, before we can acquire a just notion of the way in which the mechanical properties of air operate in applying it to the mass of blood during its passage through the lungs. Suppose the thorax quite empty, and communicating with the external air by means of the trachea or windpipe, it would then resemble a pair of bellows. Raising the boards corresponds to the raising of the ribs; and we might imitate the action of the diaphragm by forcibly pulling outwards the folded leather which unites them. Thus their capacity is enlarged, and the air rushes in at the nozzle by its weight in the same manner as water would do. The thorax differs from bellows only in this respect, that it is filled by the lungs, which is a vast collection of little bladders, like the holes in a piece of fermented bread, all communicating with the trachea, and many of them with each other. When the chest is enlarged, the air rushes into them all in the same manner as into the single cavity of an empty thorax. It cannot be said with propriety that they are inflated: all that is done is the *allowing* the air to come in. At the same time, as their membranous covering must have some thickness, however small, and some elasticity, it is not unlikely that, when compressed by expiration, they tend a little to recover their former shape, and thus aid the voluntary action of the muscles. It is in this manner that a small bladder of caoutchouc swells again after compression, and fills itself with air or water. But this cannot happen except in the most minute vesicles: those of sensible bulk have not elasticity enough for this purpose. The lungs of birds, however, have some very large bladders, which have a very considerable elasticity, and recover their shape and size with great force after compression, and thus fill themselves with air. The respiration of these animals is considerably different from that of land animals, and their muscles act chiefly in expiration. This will be explained by and by as a curious variety in the pneumatic instrument.

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We take in air not by our own action, but by external pressure.

This account of the manner in which the lungs are filled with air does not seem agreeable to the notions we entertain of it. We seem to suck in the air; but although it be true that we act, and exert force, in order to get air into our lungs, it is not by our actions, but by external pressure, that it does come in. If we apply our mouth to the top of a bottle filled with water, we find that no draught, as we call it, of our chest will suck in any of the water; but if we suck in the very same manner at the end of a pipe immersed in water, it follows immediately. Our interest in the thing makes us connect in imagination our own action with the effect, without thinking on the many steps which may intervene in the train of natural operations; and we consider the action as the immediate cause of the air's reception into the lungs. It is as if we opened the door, and took in by the hand a person who was really pushed in by the crowd without. If an incision be made into the side of the thorax, so that the air can get in by that way, when the animal acts in the usual manner, the air will really come in by this hole, and fill the space between the lungs and the thorax; but no air is sucked into the lungs by this process, and the animal is as completely suffocated as if the windpipe were shut up. And on the other hand, if a hole be made into the lungs without communicating with the thorax, the animal will breathe through this hole, though the windpipe be stopped. This is successfully performed in cases of patients whose trachea is shut up by accident or by inflammation; only it is necessary that this perforation be made into a part of the lungs where it may meet with some of the great pulmonary passages: for if made into some remote part of a lobe, the air cannot find its way into the rest of the lungs through such narrow passages, obstructed too by blood, &c.

350
Nature of expiration.

We have now explained, on pneumatical principles, the process of inspiration. The expiration is chiefly performed by the natural tone of the parts. In the act of inspiration the ribs were raised and drawn outwards in opposition to the elasticity of the solids themselves; for although the ribs are articulated at their extremities, the articulations are by no means such as to give a free and easy motion like the joints of the limbs. This is particularly the case in the articulations with the sternum, which are by no means fitted for motion. It would seem that the motion really produced here is chiefly by the yielding of the cartilaginous parts and the bending of the rib; when therefore the muscles which produced this effect are allowed to relax, the ribs again collapse. Perhaps this is assisted a little by the action of the long muscles which come down across the ribs without being inserted into them. These may draw them together a little, as we compress a loose bundle by a string.

In like manner, when the diaphragm was drawn down, it compressed the abdomen in opposition to the elasticity of all the viscera contained in it, and to the elasticity and tone of the teguments and muscles which surround it. When therefore the diaphragm is relaxed, these parts push it up again into its natural situation, and in doing this expel the air from the lungs.

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It requires no effort.

If this be a just account of the matter, expiration should be performed without any effort. This accordingly is the case. We feel that, after having made an ordinary easy inspiration, it requires the continuance of the effort to keep the thorax in this enlarged state, and that all that is necessary for expiration is to cease to act. No person feels any difficulty in emptying the lungs; but weak people often feel a difficulty of inspiration, and compare it to the feeling of a weight on their breast; and expiration is the last motion of the thorax in a dying person.

But nature has also given us a mechanism by which we can expire, namely, the abdominal muscles; and when we have finished an ordinary and easy expiration, we can still expel a considerable bulk of air, (nearly half of the contents of the lungs) by contracting the abdominal muscles. These, by compressing the body, force up its moveable contents against the diaphragm, and cause it to rise further into the thorax, acting in the same manner as when we expel the fæces *per anum*. When a person breathes out as much air as he can in this manner, he may observe that his ribs do not collapse during the whole operation.

352
A certain quantity of air necessary to keep the lungs of a natural size.

There seems then to be a certain natural unconstrained state of the vesicles of the lungs, and a certain quantity of air necessary for keeping them of this size. It is probable that this state of the lungs gives the freest motion to the blood. Were they more compressed, the blood vessels would be compressed by the adjoining vesicles; were they more lax, the vessels would be more crooked, and by this means obstructed. The frequent inspirations gradually change this air by mixing fresh air with it, and, at every expiration, carrying off some of it. In catarrhs and inflammations, especially when attended with suppuration, the small passages into the remote vessels are obstructed, and thus the renewal of air in them will be prevented. The painful feeling which this occasions causes us to expel the air with violence, shutting the windpipe, till we have exerted strongly with the abdominal muscles, and made a strong compression on the lower part of the thorax. We then open the passage suddenly, and expel the air and obstructing matter by violent coughing.

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Process of breathing in birds.

We have said, that birds exhibit a curious variety in the process of breathing. The muscles of their wings being so very great, required a very extensive insertion, and this is one use of the great breast-bone. Another use of it is, to form a firm partition to hinder the action of these muscles from compressing the thorax in the act of flying: therefore the form of their chest does not admit of alternate enlargement and contraction to that degree as in land animals. Moreover, the muscles of their abdomen are also very small; and it would seem that they are not sufficient for producing the compression on the bowels which is necessary for carrying on the process of concoction and digestion. Instead of aiding the lungs, they receive help from them.

Fig. 78.

In an ostrich, the lungs consist of a fleshy part A, A (fig. 78.), composed of vesicles like those of land animals, and, like theirs, serving to expose the blood to the action of the air. Besides these, they have on each side four large bags B, C, D, E, each of which has an orifice G communicating with the trachea; but the second, C, has also an orifice H, by which it communicates with another bag F situated below the rest in the abdomen. Now, when the lungs are compressed by the action of the diaphragm, the air in C is partly expelled by the trachea through the orifice G, and partly driven through the orifice H into the bag F, which is then allowed to receive it; because the same action which compresses the lungs enlarges the abdomen. When the thorax is enlarged, the bag C is partly supplied with fresh air through the trachea, and partly from the bag F. As the lungs of other animals resemble a common bellows, the lungs of birds resemble the smith's bellows with a partition; and anatomists have discovered passages from this part of the lungs into their hollow bones and quills. We do not know all the uses of this contrivance; and only can observe, that this alternate action must assist the muscles of the abdomen in promoting the motion of the food along the alimentary canal, &c. We can distinctly observe in birds that their belly dilates when the chest collapses, and *vice versa*, contrary to what we see in the land animals. Another use of this double passage may be to produce a circulation of air in the lungs, by which a compensation is made for the smaller surface of action on the blood; for the number of small vesicles, of equal capacity with these large bags, gives a much more extensive surface.

If we try to raise mercury in a pipe by the action of the chest alone, we cannot raise it above two or three inches; and the attempt is both painful and hazardous. It is painful chiefly in the breast, and it provokes coughing. Probably the fluids ooze through the pores of the vesicles by the pressure of the surrounding parts.

On the other hand, we can by expiration support mercury about five or six inches high: but this also is very painful, and apt to produce extravasation of blood. This seems to be done entirely by the abdominal muscles.

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The operation of sucking,

The operation properly termed SUCKING is totally different from breathing, and resembles exceedingly the action of a common pump. Suppose a pipe held in the mouth, and its lower end immersed in water. We fill the mouth with the tongue, bringing it forward, and applying it closely to the teeth and to the palate; we then draw it back, or bend it downwards (behind) from the palate, thus leaving a void. The pressure of the air on the cheeks immediately depresses them, and applies them close to the gums and teeth; and its pressure on the water in the vessel causes it to rise through the pipe into the empty part of the mouth, which it quickly fills. We then push forward the tip of the tongue, below the water, to the teeth, and apply it to them all round, the water being above the tongue, which is kept much depressed. We then apply the tongue to the palate, beginning at the tip, and gradually going backwards in this application. By this means the water is gradually forced backward by an operation similar to that of the gullet in swallowing. This is done by contracting the gullet above and relaxing it below, just as we would empty a gut of its contents by drawing our closed hand along it. By this operation the mouth is again completely occupied by the tongue, and we are ready for repeating the operation. Thus the mouth and tongue resemble the barrel and piston of a pump; and the application of the tip of the tongue to the teeth performs the office of the valve at the bottom of the barrel, preventing the return of the water into the pipe. Although usual, it is not absolutely necessary, to withdraw the tip of the tongue, making a void before the tongue. Sucking may be performed by merely separating the tongue gradually from the palate, beginning at the root. If we withdraw the tip of the tongue a very minute quantity, the water gets in and flows back above the tongue.

The action of the tongue in this operation is very powerful; some persons can raise mercury 25 inches: but this strong exertion is very fatiguing, and the soft parts are prodigiously swelled by it. It causes the blood to ooze plentifully through the pores of the tongue, fauces, and palate, in the same manner as if a cupping-glass and syringe were applied to them; and, when the inside of the mouth is excoriated or tender, as is frequent with infants, even a very moderate exertion of this kind is accompanied with extravasation of blood. When children suck the nurse's breast, the milk follows their exertion by the pressure of the air on the breast; and a weak child, or one that witholds its exertions on account of pain from the above-mentioned cause, may be assisted by a gentle pressure of the hand on the breast: the infant pupil of nature, without any knowledge of pneumatics, frequently helps itself by pressing its face to the yielding breast.

In the whole of this operation the breathing is performed through the nostrils; and it is a prodigious distress to an infant when this passage is obstructed by mucus. We beg to be forgiven for observing by the way, that this obstruction may be almost certainly removed for a little while, by rubbing the child's nose with any liquid of quick evaporation, or even with water.

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and of drinking, which is very similar.

The operation in drinking is not very different from that in sucking: we have indeed little occasion here to suck, but we must do it a little. Dogs and some other animals cannot drink, but only lap the water into their mouths with their tongue, and then swallow it. The gallinaceous birds seem to drink very imperfectly; they seem merely to dip their head into the water up to the eyes till their mouth is filled with water, and then holding up the head, it gets into the gullet by its weight, and is then swallowed. The elephant drinks in a very complicated manner: he dips his trunk into the water, and fills it by making a void in his mouth: this he does in the contrary way to man. After having depressed his tongue, he begins the application of it to the palate at the root, and by extending the application forward, he expels the air by the mouth which came into it from the trunk. The process here is not very unlike that of the condensing syringe without a piston valve, described in N° 58. in which the external air (corresponding here to the air in the trunk) enters by the hole F in the side, and is expelled through the hole in the end of the barrel; by this operation the trunk is filled with water; then he lifts his trunk out of the water, and bringing it to his mouth, pours the contents into it, and swallows it. On considering this operation, it appears that, by the same process by which the air of the trunk is taken into the mouth, the water could also be taken in, to be afterwards swallowed: but we do not find upon inquiry, that this is done by the elephant; we have always observed him to drink in the manner now described. In either way it is a double operation, and cannot be carried on any way but by alternately sucking and swallowing, and while one operation is going on the other is interrupted; whereas man can do both at the same time. Nature seems to delight in exhibiting to rational observers her inexhaustible variety of resource; for many insects, which drink with a trunk, drink without interruption: yet we do not call in question the truth of the aphorism, *Natura maxime simplex et semper sibi consona*, nor doubt but that, if the *whole* of her purpose were seen, we should find that her process is the simplest possible: for Nature, or Nature's God, is wise above our wisest thoughts, and simplicity is certainly the choice of wisdom: but alas! it is generally but a small and the most obvious part of her purpose that we can observe or appreciate. We seldom see this simplicity of nature stated to us, except by some system-maker, who has found a principle which somehow tallies with a considerable variety of phenomena, and then cries out, *Frustra fit per plura quod fieri potest per pauciora.*

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Mode of keeping up a continued blast with a blow-pipe.

There is an operation similar to that of the elephant, which many find a great difficulty in acquiring, viz. keeping up a continued blast with a blow-pipe. We would desire our chemical reader to attend minutely to the gradual action of his tongue in sucking, and he will find it such as we have described. Let him attend particularly to the way in which the tip of the tongue performs the office of a valve, preventing the return of the water into the pipe: the same position of the tongue would hinder air from coming into the mouth. Next let him observe, that in swallowing what water he has now got lodged above his tongue, he continues the tip of the tongue applied to the teeth; now let him shut his mouth, keeping his lips firm together, the tip of the tongue at the teeth, and the whole tongue forcibly kept at a distance from the palate; bring up the tongue to the palate, and allow the tip to separate a little from the teeth, this will expel the air into the space between the fauces and cheeks, and will blow up the cheeks a little: then, acting with the tip of the tongue as a valve, hinder this air from getting back, and depressing the tongue again, more air (from the nestrils) will get into the mouth, which may be expelled into the space without the teeth as before, and the cheeks will be more inflated: continue this operation, and the lips will be no longer able to retain it, and it will ooze through as long as the operation is continued. When this has become familiar and easy, take the blow-pipe, and there will be no difficulty in maintaining a blast as uniform as a smith's bellows, breathing all the while through the nostrils. The only difficulty is the holding the pipe: this fatigues the lips; but it may be removed by giving the pipe a convenient shape, a pretty flat oval, and wrapping it round with leather or thread.

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Nature of the land and sea-breeze in warm countries.

Another phenomena depending on the principles already established, is the land and sea-breeze in the warm countries.

We have seen that air expands exceedingly by heat; therefore heated air, being lighter than an equal bulk of cold air, must rise in it. If we lay a hot stone in the sunshine in a room, we shall observe the shadow of the stone surrounded with a fluttering shadow of different degrees of brightness, and that this flutter rises rapidly in a column above the stone. If we hold an extinguished candle near the stone, we shall see the smoke move towards the stone, and then ascend from it. Now, suppose an island receiving the first rays of the sun in a perfectly calm morning; the ground will soon be warmed, and will warm the contiguous air. If the island be mountainous, this effect will be more remarkable; because the inclined sides of the hills will receive the light more directly: the midland air will therefore be most warmed: the heated air will rise, and that in the middle will rise fastest; and thus a current of air upwards will begin, which must be supplied by air coming in from all sides, to be heated and to rise in its turn; and thus the morning *sea-breeze* is produced, and continues all day. This current will frequently be reversed during the night, by the air cooling and gliding down the sides of the hills, and we shall have the *land-breeze.*

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Circulation of air in mines.

It is owing to the same cause that we have a circulation of air in mines which have the mouths of their shafts of unequal heights. The temperature under ground is pretty constant through the whole year, while that of the atmosphere is extremely variable. Now, suppose a mine having a long horizontal drift, communicating between two pits or shafts, and that one of the shafts terminates in a valley, while the other opens on the brow of a hill perhaps 100 feet higher. Let us farther suppose it summer, and the air heated to 65°, while the temperature of the earth is but 45°; this last will be also the temperature of the air in the shafts and the drift. Now, since air expands nearly 24 parts in 10,000 by one degree of heat, we shall have an odds of pressure at the bottom of the two shafts equal to nearly the 20th part of the weight of a column of air 100 feet high (100 feet being supposed the difference of the heights of the shafts). This will be about six ounces on every square foot of the section of the shaft. If this pressure could be continued, it would produce a prodigious current of air down the long shafts, along the drift, and up the short shaft. The weight of the air acting through 100 feet would communicate to it the velocity of 80 feet per second: divide this by $\sqrt{20}$, that is, by 4.5, and we shall have 18 feet per second for the velocity: this is the velocity of what is called a brisk gale. This pressure *would* be continued, if the warm air which enters the long shaft were cooled and condensed as fast as it comes in; but this is not the case. *It is however cooled* and condensed, and a current is produced sufficient to make an abundant circulation of air along the whole passage; and care is taken to dispose the shafts and conduct the passages in such a manner that no part of the mine is out of the circle. When any new lateral drift is made, the renewal of air at its extremity becomes more imperfect as it advances: and when it is carried a certain length, the air stagnates and becomes suffocating, till either a communication can be made with the rest of the mine, or a shaft be made at the end of this drift.

As this current depends entirely on the difference of temperature between the air below and that above, it must cease when this difference ceases. Accordingly, in the spring and autumn, the miners complain much of stagnation; but in summer they never want a current from the deep pits to the shallow, nor in the winter a current from the shallow pits to the deep ones. It frequently happens also, that in mineral countries the chemical changes which are going on in different parts of the earth make differences of temperature sufficient to produce a sensible current.

It is easy to see that the same causes must produce a current down our chimneys in summer. The chimney is colder than the summer air, and must therefore condense it, and it will come down and run out at the doors and windows.

359
The nature of what is called the draught in chimneys.

And this naturally leads us to consider a very important effect of the expansion and consequent ascent of air by heat, namely the drawing (as it is called) of chimneys. The air which has contributed to the burning of fuel must be intensely heated, and will rise in the atmosphere. This will also be the case with much of the surrounding air which has come very near the fire, although not in contact with it. If this heated air be made to rise in a pipe, it will be kept together, and therefore will not soon cool and collapse: thus we shall obtain a long column of light air, which will rise with a force so much the greater as the column is longer or more heated. Therefore the taller we make the chimney, or the hotter we make the fire, the more rapid will be the current; or the draught or suction, as it is injudiciously called, will be so much the greater. The ascensional force is the difference between the weight of the column of heated air in the funnel and a column of the surrounding atmosphere of equal height. We increase the draught, therefore, by increasing the perpendicular height of the chimney. Its length in a horizontal direction gives no increase, but, on the contrary, diminishes the draught by cooling the air before it gets into the effective part of the funnel. We increase the draught also by obliging all the air which enters the chimney to come very near the fuel; therefore a low mantle-piece will produce this effect; also filling up all the spaces on each side of the grate. When much air gets in above the fire, by having a lofty mantle-piece, the general mass of air in the chimney cannot be much heated. Hence it must happen that the greatest draught will be produced by bringing down the mantle-piece to the very fuel; but this converts a fire-place into a furnace, and by thus sending the whole air through the fuel, causes it to burn with great rapidity, producing a prodigious heat; and this producing an increase of ascensional force, the current becomes furiously rapid, and the heat and consumption of fuel immense. If the fire-place be a cube of a foot and a half, and the front closed by a door, so that all the air must enter through the bottom of the grate, a chimney of 15 or 20 feet high, and sufficiently wide to give passage to all the expanded air which can pass through the fire, will produce a current which will roar like thunder, and a heat sufficient to run the whole inside into a lump of glass.

All that is necessary, however, in a chamber fire place, is a current sufficiently great for carrying up the smoke and vitiated air of the fuel. And as we want also the enlivening flutter and light of the fire, we give the chimney-piece both a much greater height and width than what is merely necessary for carrying up the smoke, only wishing to have the current sufficiently determinate and steady for counteracting any occasional tendency which it may sometimes have to come into the room. By allowing a greater quantity of air to get into the chimney, heated only to a moderate degree, we produce a more rapid renewal of the air of the room: did we oblige it to come so much nearer the fire as to produce the same renewal of the air in consequence of a more rapid current, we should produce an inconvenient heat. But in this country, where pit-coal is in general so very cheap, we carry this indulgence to an extreme; or rather we have not studied how to get all the desired advantages with economy. A much smaller renewal of air than we commonly produce is abundantly wholesome and pleasant, and we may have all the pleasure of the light and flame of the fuel at much less expence, by contracting greatly the passage into the vent. The best way of doing this is by contracting the brick-work on each side behind the mantle-piece, and reducing it to a narrow parallelogram, having the back of the vent for one of its long sides. Make an iron plate to fit this hole, of the same length, but broader, so that it may lie sloping, its lower edge being in contact with the foreside of the hole, and its upper edge leaning on the back of the vent. In this position it shuts the hole entirely. Now let the plate have a hinge along the front or lower edge, and fold up like the lid of a chest. We shall thus be able to enlarge the passage at pleasure. In a fire-place fit for a room of 24 feet by 18, if this plate may be about 18 inches long from side to side, and folded back within an inch or an inch and a half of the wall, this will allow passage for as much air as will keep up a very cheerful fire: and by raising or lowering this REGISTER, the fire may be made to burn more or less rapidly. A free passage of half an inch will be sufficient in weather that is not immoderately cold. The principle on which this construction produces its effect is, that the air which is in the front of the fire, and much warmed by it, is not allowed to get into the chimney, where it would be immediately hurried up the vent, but rises up to the ceiling and is diffused over the whole room. This double motion of the air may be distinctly observed by opening a little of the door and holding a candle in the way. If the candle be held near the floor, the flame will be blown into the room; but if held near the top of the door, the flame will be blown outward.

360
Description of a stove-grate or chapelle.

But the most perfect method of warming an apartment in the temperate climates, where we can indulge in the cheerfulness and sweet air produced by an open fire, is what we call a stove-grate, and our neighbours on the continent call a chapelle, from its resemblance to the chapels or oratories in the great churches.

In the great chimney-piece, which, in this case, may be made even larger than ordinary, is set a smaller one fitted up in the same style of ornament, but of a size no greater than is sufficient for holding the fuel. The sides and back of it are made of iron (cast-iron is preferable to hammered iron, because it does not so readily calcine), and are kept at a small distance from the sides and back of the main chimney-piece, and are continued down to the hearth, so that the ash-pit is also separated. The pipe or chimney of the stove grate is carried up behind the ornaments of the mantle-piece till it rises above the mantle-piece of the main chimney-piece, and is fitted with a register or damper-plate turning round a transverse axis. The best form of this register is that which we have recommended for an ordinary fire-place, having its axis or joint close at the front; so that when it is open or turned up, the burnt air and smoke striking it obliquely, are directed with certainty into the vent, without any risk of reverberating and coming out into the room. All the rest of the vent is shut up by iron plates or brick-work out of sight.

361 Effect of its construction.

The effect of this construction is very obvious. The fuel, being in immediate contact with the back and sides of the grate, heats them to a great degree, and they heat the air contiguous to them. This heated air cannot get up the vent, because the passages above these spaces are shut up. It therefore comes out into the room; some of it goes into the real fire-place and is carried up the vent, and the rest rises to the ceiling and is diffused over the room.

It is surprising to a person who does not consider it with skill how powerfully this grate warms a room. Less than one-fourth of the fuel consumed in an ordinary fire-place is sufficient; and this with the same cheerful blazing hearth and salutary renewal of air. It even requires attention to keep the room cool enough. The heat communicated to those parts in contact with the fuel is needlessly great; and it will be a considerable improvement to line this part with very thick plates of cast iron, or with tiles made of fire-clay which will not crack with the heat. These, being very bad conductors, will make the heat, ultimately communicated to the air, very moderate. If, with all these precautions, the heat should be found too great, it may be brought under perfect management by opening passages into the vent from the lateral spaces. These may be valves or trap doors moved by rods concealed behind the ornaments.

Thus we have a fire-place under the most complete regulation, where we can always have a cheerful fire without being for a quarter of an hour incommoded by the heat; and we can as quickly raise our fire, when too low, by hanging on a plate of iron on the front, which shall reach as low as the grate. This in five minutes will blow up the fire into a glow: and the plate may be sent out of the room, or set behind the stove-grate out of sight.

The propriety of inclosing the ash-pit is not so obvious; but if this be not done, the light ashes, not finding a ready passage up the chimney, will come out into the room along with the heated air.

We do not consider in this place the various extraneous circumstances which impede the current of air in our chimneys and produce smoky houses: these will be treated of, and the methods of removing or remedying them, under the article SMOKE. We consider at present only the theory of this motion in general, and the modifications of its operation arising from the various purposes to which it may be applied.

362 Mode of warming apartments by stoves.

Under this head we shall next give a general account and description of the method of warming apartments by stoves. A STOVE in general is a fire-place shut up on all sides, having only a passage for admitting the air to support the fire, and a tube for carrying off the vitiated air and smoke; and the air of the room is warmed by coming into contact with the outside of the stove and flue. The general principle of construction, therefore, is very simple. The air must be made to come into as close contact as possible with the fire, or even to pass through it, and this in such quantities as just to consume a quantity of fuel sufficient for producing the heat required; and the stove must be so constructed, that both the burning fuel and the air which has been heated by it shall be applied to as extensive a surface as possible of furnace, all in contact with the air of the room; and the heated air within the stove must not be allowed to get into the funnel which is to carry it off till it is too much cooled to produce any considerable heat on the outside of the stove.

In this temperate climate no great ingenuity is necessary for warming an ordinary apartment; and stoves are made rather to please the eye as furniture than as economical substitutes for an open fire of equal calorific power. But our neighbours on the continent, and especially towards the north, where the cold of winter is intense and fuel very dear, have bestowed much attention on their construction, and have combined ingenious economy with every elegance of form. Nothing can be handsomer than the stoves of Fayencerie that are to be seen in French Flanders, or the Russian stoves at St Petersburg, finished in stucco. Our readers will not, therefore, be displeased with a description of them. In this place, however, we shall only consider a stove in general as a subject of pneumatical discussion, and we refer our readers to the article STOVE for an account of them as articles of domestic accommodation.

363 General form of a stove.

The general form, therefore, of a stove, and of which all others are only modifications adapted to circumstances of utility or taste, is as follows:

Fig. 79.

MIKL (fig. 79.) is a quadrangular box of any size in the directions MILK. The inside width from front to back is pretty constant, never less than ten inches, and rarely extending to 20; the included space is divided by a great many partitions. The lowest chamber AB is a receptacle for the fuel, which lies on the bottom of the stove without any grate; this fire-place has a door AO turning on hinges, and in this door is a very small wicket P: the roof of the fire-place extends to within a very few inches of the farther end, leaving a narrow passage B for the flame. The next partition *c* C is about eight inches higher, and reaches almost to the other end, leaving a narrow passage for the flame at C. The partitions are repeated above, at the distance of eight inches, leaving passages at the ends, alternately disposed as in the figure; the last of them H communicates with the room vent. This communication may be regulated by a plate of iron, which can be slid across it by means of a rod or handle which comes through the side. The more usual way of shutting up this passage is by a sort of pan or bowl of earthen ware, which is whelmed over it with its brim resting in sand contained in a groove formed all round the hole. This damper is introduced by a door in the front, which is then shut. The whole is set on low pillars, so that its bottom may be a few inches from the floor of the room: it is usually placed in a corner, and the apartments are so disposed that their chimneys can be joined in stacks as with us.

Some straw or wood-shavings are first burnt on the hearth at its farther end. This warms the air in the stove, and creates a determined current. The fuel is then laid on the hearth close by the door, and pretty much piled up. It is now kindled; and the current being already directed to the vent, there is no danger of any smoke coming out into the room. Effectually to prevent this, the door is shut, and the wicket P opened.

ed. The air supplied by this, being directed to the middle or bottom of the fuel, quickly kindles it, and the operation goes on.

364 Aim and effects of this construction.

The aim of this construction is very obvious. The flame and heated air are retained as long as possible within the body of the stove by means of the long passages; and the narrowness of these passages obliges the flame to come in contact with every particle of soot, so as to consume it completely, and thus convert the whole combustible matter of the fuel into heat. For want of this a very considerable portion of our fuel is wasted by our open fires, even under the very best management: the soot which sticks to our vents is very inflammable, and a pound weight of it will give as much if not more heat than a pound of coal. And what sticks to our vents is very inconsiderable in comparison with what escapes unconsumed at the chimney top. In fires of green wood, peat, and some kinds of pit-coal, nearly one-fifth of the fuel is lost in this way; but in these stoves there is hardly ever any mark of soot to be seen; and even this small quantity is produced only after lighting the fires. The volatile inflammable matters are expelled from parts much heated indeed, but not so hot as to burn; and some of it charred or half burnt cannot be any further consumed, being enveloped in flame and air already vitiated and unfit for combustion. But when the stove is well heated, and the current brisk, no part of the soot escapes the action of the air.

The hot air retained in this manner in the body of the stove is applied to its sides in a very extended surface. To increase this still more, the stove is made narrower from front to back in its upper part; a certain breadth is necessary below, that there may be room for fuel. If this breadth were preserved all the way up, much heat would be lost, because the heat communicated to the partitions of the stove does no good. By diminishing their breadth, the proportion of useful surface is increased. The whole body of the stove may be considered as a long pipe folded up, and its effect would be the greatest possible if it really were so; that is, if each partition c C, d D, &c. were split into two, and a free passage allowed between them for the air of the room. Something like this will be observed afterwards in some German stoves.

It is with the same view of making an extensive application of a hot surface to the air, that the stove is not built in the wall, not even in contact with it, nor with the floor: for by its detached situation, the air in contact with the back, and with the bottom (where it is hottest), is warmed, and contributes at least one half of the whole effect; for the great heat of the bottom makes its effect on the air of the room at least equal to that of the two ends. Sometimes a stove makes part of the wall between two small rooms, and is found sufficient.

It must be remarked, on the whole, that the effect of a stove depends much on keeping in the room the air already heated by it. This is so remarkably the case, that a small open fire in the same room will be so far from increasing its heat, that it will greatly diminish it: it will even draw the warm air from a suite of adjoining apartments. This is distinctly observed in the houses of the English merchants in St Petersburgh: their habits of life in Britain make them uneasy without an open fire in their sitting rooms; and this obliges them to heat all their stoves twice a-day, and their houses are cooler than those of the Russians who heat them only once. In many German houses, especially of the lower class, the fire-place of the stove does not open into the room, but into the yard or a lobby, where all the fires are lighted and tended; by this means is avoided the expence of warm air which must have been carried off by the stove: but it is evident that this must be very unpleasant, and cannot be wholesome. We must breathe the same quantity of stagnant air loaded with all the vapours and exhalations which must be produced in every inhabited place. Going into one of these houses from the open air, is like putting one's head into a stew-pan or under a pie-crust, and quickly nauseates us who are accustomed to fresh air and cleanliness. In these countries it is a matter almost of necessity to fumigate the rooms with frankincense and other gums burnt. The censer in ancient worship was in all probability an utensil introduced by necessity for sweetening or rendering tolerable the air of a crowded place: and it is a constant practice in the Russian houses for a servant to go round the room after dinner, waving a censer with some gums burning on bits of charcoal.

365 Of hot walls in gardening, &c.

The account now given of stoves for heating rooms, and of the circumstances which must be attended to in their construction, will equally apply to hot walls in gardening, whether within or without doors. The only new circumstance which this employment of a flue introduces, is the attention which must be paid to the equability of the heat, and the gradation which must be observed in different parts of the building. The heat in the flue gradually diminishes as it recedes from the fire-place, because it is continually giving out heat to the flue. It must therefore be so conducted through the building by frequent returns, that in every part there may be a mixture of warmer and cooler branches of the flue, and the final chimney should be close by the fire-place. It would, however, be improper to run the flue from the end of the floor up to the ceiling, where the second horizontal pipe would be placed, and then return it downward again and make the third horizontal flue adjoining to the first, &c. This would make the middle of the wall the coldest. If it is the flue of a greenhouse, this would be highly improper, because the upper part of the wall can be very little employed; and in this case it is better to allow the flue to proceed gradually up the wall in its different returns, by which the lowest part would be the warmest, and the heated air will ascend among the pots and plants; but in a hot wall, where the trees are to receive heat by contact, some approximation to the above method may be useful.

In the hypocausta and sudaria of the Greeks and Romans, the flue was conducted chiefly under the floors.

366 Malt-kilns a species of stove.

Malt-kilns are a species of stove which merit our attention. Many attempts have been made to improve them on the principle of flue stoves: but they have been unsuccessful, because heat is not what is chiefly wanted in malting: it is a copious current of very dry air to carry off the moisture. We must refer the examination of this subject also to the article STOVE, and proceed to consider the current of heated air in the chief varieties of furnaces.

367 Of the current of air in melting furnaces.

All that is to be attended to in the different kinds of melting furnaces is, that the current of air be sufficiently rapid, and that it be applied in as extensive a surface as possible to the substance to be melted. The more rapid the current it is the hotter, because it is consuming more fuel; and therefore its effect increases in a higher proportion than its rapidity. It is doubly effectual if twice as hot; and if it then be twice as rapid, there is twice the quantity of doubly hot air applied to the subject; it would therefore be four times more powerful. This is procured by raising the chimney of the furnace to a greater height. The close application of it to the subject can hardly be laid down in general terms, because it depends on the precise circumstances of each case.

368 in reverberatory furnaces,

In reverberatory furnaces, such as refining furnaces for gold, silver, and copper, the flame is made to play over the surface of the melted metal. This is produced entirely by the form of the furnace, by making the arch of the furnace as low as the circumstances of the manipulation will allow. See FURNACE. Experience has pointed out in general the chief circumstances of their construction, viz. that the fuel should be at one end on a grate, through which the air enters to maintain the fire; and that the metal should be placed on a level floor between the fuel and the tall chimney which produces the current. But there is no kind of furnace more variable in its effect, and almost every place has a small peculiarity of construction, on which its pre-eminence is rested. This has occasioned many whimsical varieties in their form. This uncertainty seems to depend much on a circumstance rather foreign to our present purpose; but as we do not observe it taken notice of by mineralogical writers, we beg leave to mention it here. It is not heat alone that is wanted in the refining of silver by lead, for instance. We must make a continual application to its surface of air, which has not contributed to the combustion of the fuel. Any quantity of the hottest air, already saturated with the fuel, may play on the surface of the metal for ever, and keep it in the state of most perfect fusion, but without refining it in the least. Now, in the ordinary construction of a furnace, that is much the case. If the whole air has come in by the grate, and passed through the middle of the fuel, it can hardly be otherwise than nearly saturated with it; and if air be also admitted by the door (which is generally done or something equivalent), the pure air lies above the vitiated air, and during the passage along the horizontal part of the furnace, and along the surface of the metal, it still keeps above it, at least there is nothing to promote their mixture. Thus the metal does not come into contact with air fit to act on the base metal and calcine it, and the operation of refining goes on slowly. Trifling circumstances in the form of the arch or canal may tend to promote the jumbling of the airs together, and thus render the operation more expeditious; and as these are but ill understood, or perhaps this circumstance not attended to, no wonder that we see these considered as so many nostrums of great importance. It were therefore worth while to try the effect of changes in the form of the roof directed to this very circumstance. Perhaps some little prominence down from the arch of the reverberatory would have this effect, by suddenly throwing the current into confusion. If the additional length of passage do not cool the air too much, we should think that if there were interposed between the fuel and the refining floor a passage twisted like a cork-screw, making just half a turn, it would be most effectual: for we imagine, that the two airs, keeping each to their respective sides of the passage, would by this means be turned upside down, and that the pure stratum would now be in contact with the metal, and the vitiated air would be above it.

369 and in the glasshouse furnaces.

The glasshouse furnace exhibits the chief variety in the management of the current of heated air. In this it is necessary that the hole at which the workman dips his pipe into the pot shall be as hot as any part of the furnace. This could never be the case, if the furnace had a chimney situated in a part above the dipping-hole; for in this case cold air would immediately rush in at the hole, play over the surface of the pot, and go up the chimney. To prevent this the hole itself is made the chimney; but as this would be too short, and would produce very little current and very little heat, the whole furnace is set under a tall dome. Thus the heated air from the real furnace is confined in this dome, and constitutes a high column of very light air, which will therefore rise with great force up the dome, and escape at the top. The dome is therefore the chimney, and will produce a draught or current proportioned to its height. Some are raised above a hundred feet. When all the doors of this house are shut, and thus no supply given except through the fire, the current and heat become prodigious. This, however, cannot be done, because the workmen are in this chimney, and must have respirable air. But notwithstanding this supply by the house-doors, the draught of the real furnace is vastly increased by the dome, and a heat produced sufficient for the work, and which could not have been produced without the dome.

370 Improvement of Mr Cotterel for melting iron from the ore.

This has been applied with great ingenuity and effect to a furnace for melting iron from the ore, and an iron finery, both without a blast. The common blast iron furnace is well known. It is a tall cone with the apex undermost. The ore and fluxes are thrown into this cone mixed intimately with the fuel till it is full, and the blast of most powerful bellows is directed into the bottom of this cone through a hole in the side. The air is thrown in with such force, that it makes its way through the mass of matter, kindles the fuel in its passage, and fluxes the materials, which then drop down into a receptacle below the blast-hole, and thus the passage for the air is kept unobstructed. It was thought impossible to produce or maintain this current without bellows; but Mr Cotterel, an ingenious founder, tried the effect of a tall dome placed over the mouth of the furnace, and though it was not half the height of many glasshouse domes it had the desired effect. Considerable difficulties, however, occurred; and he had not surmounted them all when he left the neighbourhood of Edinburgh, nor have we since heard that he has brought the invention to perfection. It is extremely difficult to place the holes below, at which the air is to enter, at such a precise height as neither to be choked by the melted matter, nor to leave ore and stones below them unmelted; but the invention is very ingenious, and will be of immense service if it can be perfected; for in many places iron ore is to be found where water cannot be had for working a blast furnace.

The last application which we shall make of the currents produced by heating the air is to the freeing mines, ships, prisons, &c. from the damp and noxious vapours which frequently infest them.

371 Currents of air applied to free mines, ships, prisons, &c. of noxious air.

As a drift or work is carried on in the mine, let a trunk of deal boards, about 6 or 8 inches square, be laid along the bottom of the drift, communicating with a trunk carried up in the corner of one of the shafts. Let the top of this last trunk open into the ash-pit of a small furnace, having a tall chimney. Let fire be kindled in the furnace; and when it is well heated, shut the fire-place and ash-pit doors. There being no other supply for the current produced in the chimney of this furnace, the air will flow into it from the trunk, and will bring along with it all the offensive vapours. This is the most effectual method yet found out. In the same manner may trunks be conducted into the ash-pit of a furnace from the cells of a prison or the wards of an hospital.

372 Air necessary for the combustion of fuel.

In the account which we have been giving of the management of air in furnaces and common fires, we have frequently mentioned the immediate application of air to the burning fuel as necessary for its combustion. This is a general fact. In order that any inflammable body may be really inflamed, and its combustible matter consumed and ashes produced, it is not enough that the body be made hot. A piece of charcoal inclosed in a box of iron may be kept red hot for ever, without wasting its substance in the smallest degree. It is farther necessary that it be in contact with a particular species of air, which constitutes about three-fourths of the air of the atmosphere, viz. the vital air or oxygen of Lavoisier. It was called *empyreal air* by Scheele, who first observed its indispensable use in maintaining fire: and it appears, that, in contributing to the combustion of an inflammable body, this air combines with some of its ingredients, and becomes fixed air, suffering the same change as by the breathing of animals. Combustion may therefore be considered as a solution of the inflammable body in air. This doctrine was first promulgated by the celebrated Dr Hooke in his *Micrographia*, published in 1660, and afterwards improved in his treatise on Lamps. It is now completely established, and considered as a new discovery. It is for this reason, that in fire-places of all kinds we have directed the construction, so as to produce a close application of the air to the fuel. It is quite needless at this day to enter into the discussions which formerly occupied philosophers about the manner in which the pressure and elasticity of the air promoted combustion. Many experiments were made in the 17th century by the first members of the Royal Society, to discover the office of air in combustion. It was thought that the flame was extinguished in rare air for want of a pressure to keep it together; but this did not explain its extinction when the air was not renewed. These experiments are still retained in courses of experimental philosophy, as they are judiciously styled; but they give little or no information, nor tend to the illustration of any pneumatical doctrine; they are therefore omitted in this place. In short, it is now fully established, that it is not a mechanical but a chemical phenomenon. We can only inform the chemist, that a candle will consume faster in the low countries than in the elevated regions of Quito and Gondar, because the air is nearly one half denser below, and will act proportionally faster in decomposing the candle.

373 Curious effects of the air's pressure.

We shall conclude this part of our subject with the explanation of a curious phenomenon observed in many places. Certain springs or fountains are observed to have periods of repletion and scantiness, or seem to ebb and flow at regular intervals; and some of these periods are of a complicated nature. Thus a well will have several returns of high and low water, the difference of which gradually increases to a maximum, and then diminishes, just as we observe in the ocean. A very ingenious and probable explanation of this has been given in N° 424. of the Philosophical Transactions, by Mr Atwell, as follows.

Fig. 80.

Let ABCD (fig. 80.) represent a cavern, into which water is brought by the subterraneous passage OT. Let it have an outlet MNP, of a crooked form, with its highest part N considerably raised above the bottom of the cavern, and thence sloping downwards into lower ground, and terminating in an open well at P. Let the dimensions of this canal be such that it will discharge much more water than is supplied by TO. All this is very natural, and may be very common. The effect of this arrangement will be a remitting spring at P: for when the cavern is filled higher than the point N, the canal MNP will act as a syphon; and, by the conditions assumed, it will discharge the water faster than TO supplies it; it will therefore run it dry, and then the spring at P will cease to furnish water. After some time the cavern will again be filled up to the height N, and the flow at P will recommence.

If, besides this supply, the well P also receive water from a constant source, we shall have a reciprocating spring.

The situation and dimensions of this syphon canal, and the supply of the feeder, may be such, that the efflux at P will be constant. If the supply increase in a certain degree, a reciprocation will be produced at P with very short intervals; if the supply diminishes considerably, we shall have another kind of reciprocation with great intervals and great differences of water.

If the cavern have another simple outlet R, new varieties will be produced in the spring P, and R will afford a copious spring. Let the mouth of R, by which the water enters into it from the cavern, be lower than N, and let the supply of the feeding spring be no greater than R can discharge, we shall have a constant spring from R, and P will give no water. But suppose that the main feeder increases in winter or in rainy seasons, but not so much as will supply both P and R, the cavern will fill till the water gets over N, and R will be running all the while; but soon after P has begun to flow, and the water in the cavern sinks below R, the stream from R will stop. The cavern will be emptied by the syphon canal MNP, and then P will stop. The cavern will then begin to fill, and when near full R will give a little water, and soon after P will run and R stop as before, &c.

Desagulier shows, vol. ii. p. 177, &c. in what manner a prodigious variety of periodical ebbs and flows may be produced by underground canals, which are extremely simple and probable.

374 Account of some pneumatic engines.

WE shall conclude this article with the descriptions of some pneumatical machines or engines which have not been particularly noticed under their names in the former volumes of this work.

Bellows are of most extensive and important use; and it will be of service to describe such as are of uncommon construction and great power, fit for the great operations in metallurgy.

It is not the impulsive force of the blast that is wanted in most cases, but merely the copious supply of air, to produce the rapid combustion of inflammable matter; and the service would be better performed in general if this could be done with moderate velocities, and an extended surface. What are called air-furnaces, where a considerable surface of inflammable matter is acted on at once by the current which the mere heat of the expended air has produced, are found more operative in proportion to the air expended than blast furnaces animated by bellows; and we doubt not but that the method proposed by Mr Cotterel, (which we have already mentioned) of increasing this current in a melting furnace by means of a dome, will in time supersede the blast furnaces. There is indeed a great impulsive force required in some cases; as for blowing off the scoriæ from the surface of silver or copper in refining furnaces, or for keeping a clear passage for the air in the great iron furnace.

In general, however, we cannot procure this abundant supply of air any other way than by giving it a great velocity by means of a great pressure, so that the general construction of bellows is pretty much the same in all kinds. The air is admitted into a very large cavity, and then expelled from it through a small hole.

Plate ccccxxxii. fig. 92.

Fig. 93.

Fig. 94.

The furnaces at the mines having been greatly enlarged, it was necessary to enlarge the bellows also: and the leathern bellows becoming exceedingly expensive, wooden ones were substituted in Germany about the beginning of the 17th century, and from them became general through Europe. They consist of a wooden box ABCPFE (fig. 92.), which has its top and two sides flat or straight, and the end BAE *e* formed into an arched or cylindrical surface, of which the line FP at the other end is the axis. This box is open below, and receives within it the shallow box KHGNML (fig. 93.), which exactly fills it. The line FP of the one coincides with FP of the other, and along this line is a set of hinges on which the upper box turns as it rises and sinks. The lower box is made fast to a frame fixed in the ground. A pipe OQ proceeds from the end of it, and terminates at the furnace, where it ends in a small pipe called the *tewer* or *tuyere*. This lower box is open above, and has in its bottom two large valves V, V, fig. 94. opening inwards. The conducting pipe is sometimes furnished with a valve opening outwards, to prevent burning coals from being sucked into the bellows when the upper box is drawn up. The joint along PF is made tight by thin leather nailed along it. The sides and ends of the fixed box are made to fit the sides and curved end of the upper box, so that this last can be raised and lowered round the joint FP without sensible friction, and yet without suffering much air to escape: but as this would not be sufficiently air-tight by reason of the shrinking and warping of the wood, a farther contrivance is adopted. A slender lath of wood, divided into several joints, and covered on the outer edge with very soft leather, is laid along the upper edges of the sides and ends of the lower box. This lath is so broad, that when its inner edge is even with the inside of the box, its outer edge projects about an inch. It is kept in this position by a number of steel wires, which are driven into the bottom of the box, and stand up touching the sides, as represented in fig. 95. where *a b c* are the wires, and *e* the lath, projecting over the outside of the box. By this contrivance the laths are pressed close to the sides and curved end of the moveable box, and the spring wires yield to all their inequalities. A bar of wood RS (fig. 92.) is fixed to the upper board, by which it is either raised by machinery, to sink again by its own weight, having an additional load laid on it, or it is forced downward by a crank or wiper of the machinery, and afterwards raised.

Fig. 95.

Fig. 92.

The operation here is precisely similar to that of blowing with a chamber-bellows. When the board is lifted up, the air enters by the valves V, V, fig. 94. and is expelled at the pipe OQ by depressing the boards. There is therefore no occasion to insist on this point.

These bellows are made of a very great size, AD being 16 feet, AB five feet, and the circular end AE also five feet. The rise, however, is but about 3 or $3\frac{1}{2}$ feet. They expel at each stroke about 90 cubic feet of air, and they make about 8 strokes per minute.

Such are the bellows in general use on the continent. We have adopted a different form in this kingdom, which seems much preferable. We use an iron or wooden cylinder, with a piston sliding along it. This may be made with much greater accuracy than the wooden boxes, at less expence, if of wood, because it may be of coopers work, held together by hoops; but the great advantage of this form is its being more easily made air-tight. The piston is surrounded with a broad strap of thick and soft leather, and it has around its edge a deep groove, in which is lodged a quantity of wool. This is called the packing or stuffing, and keeps the leather very closely applied to the inner surface of the cylinder. Iron cylinders may be very neatly bored and smoothed, so that the piston, even when very tight, will slide along it very smoothly. To promote this, a quantity of black lead is ground very fine with water, and a little of this is smeared on the inside of the cylinder from time to time.

The cylinder has a large valve, or sometimes two, in the bottom, by which the atmospheric air enters when the piston is drawn up. When the piston is thrust down, this air is expelled along a pipe of great diameter, which terminates in the furnace with a small orifice.

Fig. 96.

This is the simplest form of bellows which can be conceived. It differs in nothing but size from the bellows used by the rudest nations. The Chinese smiths have a bellows very similar, being a square pipe of wood ABCDE (fig. 96.), with a square board G which exactly fits it, moved by the handle FG. At the farther end is the blast pipe HK, and on each side of it a valve in the end of the square pipe, opening inwards. The piston is sufficiently tight for their purposes without any leathering.

The piston of this cylinder bellows is moved by machinery. In some blast engines the piston is simply raised by the machine, and then let go, and it descends by its own weight, and compresses the air below it to such a degree, that the velocity of efflux becomes constant, and the piston descends uniformly: for this purpose it must be loaded with a proper weight. This produces a very uniform blast, except at the very beginning, while the piston falls suddenly and compresses the air: but in most engines the piston rod is forced down the cylinder with a determined motion, by means of a beam, crank, or other contrivance. This gives a more unequal blast because the motion of the piston is necessarily slow in the beginning and end of the stroke, and quicker in the middle.

But in all it is plain that the blast must be desultory. It ceases while the piston is rising; for this reason it is usual to have two cylinders, as it was formerly usual to have two bellows, which worked alternately. Sometimes three or four are used, as at the Carron iron works. This makes the blast abundantly uniform.

But an uniform blast may be made with a single cylinder, by making it deliver its air into another cylinder, which has a piston exactly fitted to its bore, and loaded with a sufficient weight. The blowing cylinder Fig. 97. ABCD (fig. 97.) has its piston P worked by a rod NP, connected by double chains with the arched head of the working beam NO, moving round a gudgeon at R. The other end O of this beam is connected by the rod OP, with the crank PQ of a wheel machine; or it may be connected with the piston of a steam engine, &c. &c. The blowing cylinder has a valve or valves E in its bottom, opening inwards. There proceeds from it a large pipe CF, which enters the regulating cylinder GHKI, and has a valve at top to prevent the air from getting back into the blowing cylinder. It is evident that the air forced into the cylinder must raise its piston L, and that it must afterwards descend, while the other piston is rising. It must descend uniformly, and make a perfectly equable blast.

Observe, that if the piston L be at the bottom when the machine begins to work, it will be at the bottom at the end of every stroke, if the *tuyere* T emits as much air as the cylinder ABCD furnishes; nay, it will lie a while at the bottom, for, while it was rising, air was issuing through T. This would make an interrupted blast. To prevent this, the orifice T must be lessened; but then there will be a surplus of air at the end of each stroke, and the piston L will rise continually, and at last get to the top, and allow air to escape. It is just possible to adjust circumstances, so that neither shall happen. This is done easier by putting a stop in the way of the piston, and putting a valve on the piston, or on the conducting pipe KST, loaded with a weight a little superior to the intended elasticity of the air in the cylinder. Therefore, when the piston is prevented by the stop from rising, the snifting valve, as it is called, is forced open, the superfluous air escapes, and the blast preserves its uniformity.

It may be of use to give the dimensions of a machine of this kind, which has worked for some years at a very great furnace, and given satisfaction.

The diameter of the blowing cylinder is 5 feet, and the length of the stroke is 6. Its piston is loaded with $3\frac{1}{2}$ tons. It is worked by a steam engine whose cylinder is 3 feet 4 inches wide, with a six-feet stroke. The regulating cylinder is 8 feet wide, and its piston is loaded with $8\frac{1}{2}$ tons, making about 2.63 pounds on the square inch; and it is very nearly in equilibrio with the load on the piston of the blowing cylinder. The conducting pipe KST is 12 inches in diameter, and the orifice of the tuyere was $\frac{5}{8}$ of an inch when the engine was erected, but it has gradually enlarged by reason of the intense heat to which it is exposed. The snifting valve is loaded with 3 pounds on the square inch.

When the engine worked briskly, it made 18 strokes per minute, and there was always much air discharged by the snifting valve. When the engine made 15 strokes per minute, the snifting valve opened but seldom, so that things were nearly adjusted to this supply. Each stroke of the blowing cylinder sent in 118 cubic feet of common air. The ordinary pressure of the air being supposed $14\frac{3}{4}$ pounds on an inch, the density of the air in the regulating cylinder must be $\frac{14.75+2.63}{14.75}, =1.1783$, the natural density being 1.

This machine gives an opportunity of comparing the expence of air with the theory. It must (at the rate of 15 strokes) expel 30 cubic feet of air in a second through a hole of $1\frac{5}{8}$ inches in diameter. This gives a velocity of near 2000 feet per second, and of more than 1600 feet for the condensed air. This is vastly greater than the theory can give, or is indeed possible; for air does not rush into a void with so great velocity. It shows with great evidence, that a vast quantity of air must escape round the two pistons. Their united circumferences amount to above 40 feet, and they move in a dry cylinder. It is impossible to prevent a very great loss. Accordingly, a candle held near the edge of the piston L has its flame very much disturbed. This case therefore gives no hold for a calculation; and it suggests the propriety of attempting to diminish this great waste.

This has been very ingeniously done (in part at least) at some other furnaces. At Omoah foundry, near Glasgow, the blowing cylinder (also worked by a steam engine) delivers its air into a chest without a bottom, which is immersed in a large cistern of water, and supported at a small height from the bottom of the cistern, and has a pipe from its top leading to the tuyere. The water stands about five feet above the lower brim of the regulating air-chest, and by its pressure gives the most perfect uniformity of blast, without allowing a particle of air to get off by any other passage besides the tuyere. This is a very effectual regulator, and must produce a great saving of power, because a smaller blowing cylinder will thus supply the blast. We must observe, that the loss round the piston of the blowing cylinder remains undiminished.

A blowing machine was erected many years ago at Chastillon in France on a principle considerably different, and which must be perfectly air-tight throughout. Two cylinders AB (fig. 98.), loaded with great weights, were suspended at the end of the levers CD, moving round the gudgeon E. From the top F, G of each there was a large flexible pipe which united in H, from whence a pipe KT led to the tuyere T. There were valves at F and G opening outwards, or into the flexible pipes; and other valves L, M, adjoining to them in the top of each cylinder, opening inwards, but kept shut by a slight spring. Motion was given to the lever by a machine. The operation of this blowing machine is evident. When the cylinder A was pulled down, or allowed to descend, the water, entering at its bottom, compressed the air, and forced it along the passage FHKT. In the mean time, the cylinder B was rising, and the air entered by the valve M. We see that the blast will be very unequal, increasing as the cylinder is immersed deeper. It is needless to describe this machine more particularly, because we shall

Plate ccccxxiii fig. 98.

give an account of one which we think perfect in its kind, and which leaves hardly any thing to be desired in a machine of this sort. It was invented by Mr John Laurie, land-surveyor in Edinburgh, about 15 years ago, and improved in some respects since his death by an ingenious person of that city.

Fig. 99. ABCD (fig. 99.) is an iron cylinder, truly bored within, and evasated a-top like a cup. EFGH is another, truly turned both without and within, and a small matter less than the inner diameter of the first cylinder. This cylinder is close above, and hangs from the end of a lever moved by a machine. It is also loaded with weights at N. KILM is a third cylinder, whose outside diameter is somewhat less than the inside diameter of the second. This inner cylinder is fixed to the same bottom with the outer cylinder. The middle cylinder is loose, and can move up and down between the outer and inner cylinders without rubbing on either of them. The inner cylinder is perforated from top to bottom by three pipes OQ, SV, PR. The pipes OQ, PR have valves at their upper ends O, P, and communicate with the external air below. The pipe SV has a horizontal part VW, which again turns upwards, and has a valve at top X. This upright part WX is in the middle of a cistern of water *f h k g*. Into this cistern is fixed an air-chest *a* YZ *b*, open below, and having at top a pipe *c d e* terminating in the tuyere at the furnace.

When the machine is at rest, the valves X, O, P, are shut by their own weights, and the air-chest is full of water. When things are in this state, the middle cylinder EFGH is drawn up by the machinery till its lower brims F and G are equal with the top RM of the inner cylinder. Now pour in water or oil between the outer and middle cylinders: it will run down and fill the space between the outer and inner cylinders. Let it come to the top of the inner cylinder.

Now let the loaded middle cylinder descend. It cannot do this without compressing the air which is between its top and the top of the inner cylinder. This air being compressed will cause the water to descend between the inner and middle cylinders, and rise between the middle and outer cylinders, spreading into the cup; and as the middle cylinder advances downwards, the water will descend farther within it, and rise farther without it. When it has got so far down, and the air has been so much compressed, that the difference between the surface of the water on the inside and outside of this cylinder is greater than the depth of water between X and the surface of the water *f g*, air will go out by the pipe SVW, and will lodge in the air-chest, and will remain there if *c* be shut, which we shall suppose for the present. Pushing down the middle cylinder till the partition touch the top of the inner cylinder, all the air which was formerly between them will be forced into the air chest, and will drive out water from it. Draw up the middle cylinder, and the external air will open the valves O, P, and again fill the space between the middle and inner cylinders; for the valve X will shut, and prevent the regress of the condensed air. By pushing down the middle cylinder a second time, more air will be forced into the air-chest, and it will at last escape by getting out between its brims Y, Z and the bottom of the cistern; or if we open the passage *c*, it will pass along the conduit *c d e* to the tuyere, and form a blast.

The operation of this machine is similar to Mr Haskin's quicksilver pump described by Desaguliers at the end of the second volume of his Experimental Philosophy. The force which condenses the air is the load on the middle cylinder. The use of the water between the inner and outer cylinders is to prevent this air from escaping; and the inner cylinder thus performs the office of a piston, having no friction. It is necessary that the length of the outer and middle cylinders be greater than the depth of the regulator-cistern, that there may be a sufficient height for the water to rise between the middle and outer cylinders, to balance the compressed air, and oblige it to go into the air-chest. A large blast-furnace will require the regulator-cistern five feet deep, and the cylinders about six or seven feet long.

It is in fact a pump without friction, and is perfectly air-tight. The quickness of its operation depends on the small space between the middle cylinder and the two others; and this is the only use of these two. Without these it would be similar to the engine at Chastillon, and operate more unequally and slowly. Its only imperfection is, that if the cylinder begin its motion of ascent or descent rapidly, as it will do when worked by a steam-engine, there will be some danger of water dashing over the top of the inner cylinder and getting into the pipe SV; but should this happen, an issue can easily be contrived for it at V, covered with a loaded valve *v*. This will never happen if the cylinder is moved by a crank.

One blowing cylinder only is represented here, but two may be used.

We do not hesitate in recommending this form of bellows as the most perfect of any, and fit for all uses where standing bellows are required. They will be cheaper than any other sort for common purposes. For a common smith's forge they may be made with square wooden boxes instead of cylinders They are also easily repaired. They are perfectly tight; and they may be made with a blast almost perfectly uniform, by making the cistern in which the air-chest stands of considerable dimensions. When this is the case, the height of water, which regulates the blast, will vary very little.

This may suffice for an account of blast machines. The leading parts of their construction have been described as far only as was necessary for understanding their operation, and enabling an engineer to erect them in the most commodious manner. Views of complete machines might have amused, but they would not have added to our reader's information.

But the account is imperfect unless we show how their parts may be so proportioned that they shall perform what is expected from them. The engineer should know what size of bellows, and what load on the board or piston, and what size of tuyere, will give the blast which the service requires, and what force must be employed to give them the necessary degree of motion. We shall accomplish these purposes by considering the efflux of the compressed air through the tuyere. The propositions formerly delivered will enable us to ascertain this.

That we may proportion every thing to the power employed, we must recollect, that if the piston of a cylinder employed for expelling air be pressed down with any force p, it must be considered as superadded to the atmospheric pressure P on the same piston, in order that we may compare the velocity v of efflux with the known velocity V with which air rushes into a void. By what has been formerly delivered, it appears that this velocity $v = V \times \sqrt{\frac{p}{P \times p}}$, where P is the pressure of the atmosphere on the piston, and p the additional load laid on it. This velocity is expressed in feet per second; and, when multiplied by the area of the orifice (also expressed in square feet, it will give us the cubical feet of condensed air expelled in a second: but the bellows are always to be filled again with common air, and therefore we want to know the quantity of common air which will be expelled; for it is this which determines the number of strokes which must be made in a minute, in order that the proper supply may be obtained. Therefore recollect that the quantity expelled from a given orifice with a given velocity, is in the proportion of the density; and that when D is the density of common air produced by the pressure P, the density d produced by the pressure $P+p$, is $D \times \frac{P+p}{P}$; or if D be made 1, we have $d = \frac{P+p}{P}$.

Therefore, calling the area of the orifice expressed in square feet O, and the quantity of common air, or the cubic feet expelled in a second Q, we have $Q = V \times O \times \sqrt{\frac{p}{P+p}} \times \frac{P+p}{P}$.

It will be sufficiently exact for all practical purposes to suppose P to be 15 pounds on every square inch of the piston; and p is then conveniently expressed by the pounds of additional load on every square inch: we may also take $V = 1332$ feet.

As the orifice through which the air is expelled is generally very small, never exceeding three inches in diameter, it will be more convenient to express it in square inches; which being the $\frac{1}{144}$ of a square foot, we shall have the cubic feet of common air expelled in a second, or $Q = \frac{1332}{144} O \sqrt{\frac{p}{P+p}} \times \frac{P+p}{P}, = O \times 9.25 \times \sqrt{\frac{p}{P+p}} \times \frac{P+p}{P}$; and this seems to be as simple an expression as we can obtain.

This will perhaps be illustrated by taking an example in numbers. Let the area of the piston be four square feet, and the area of the round hole through which the air is expelled be two inches, its diameter being 1.6, and let the load on the piston be 1728 pounds: this is three pounds on every square inch. We have $P = 15$. $p = 3$, $P+p = 18$, and $O = 2$; therefore we will have $Q = 2 \times 9.25 \times \sqrt{\frac{3}{18}} \times \frac{18}{15}, = 9.053$ cubic feet of common air expelled in a second. This will however be diminished at least one-third by the contraction of the jet; and therefore the supply will not exceed six cubic feet per second. Supposing therefore that this blowing machine is a cylinder or prism of this dimension in its section, the piston so loaded would (after having compressed the air) descend about 15 inches in a second: It would first sink one-fifth of the whole length of the cylinder pretty suddenly, till it had reduced the air to the density $\frac{18}{15}$, and would then descend uniformly at the above rate, expelling six cubic feet of common air in a second.

The computation is made much in the same way for bellows of the common form, with this additional circumstance, that as the loaded board moves round a hinge at one end, the pressure of the load must be calculated accordingly. The computation, however, becomes a little intricate, when the form of the loaded board is not rectangular: it is almost useless when the bellows have flexible sides, either like smiths bellows or like organ bellows, because the change of figure during their motion makes continual variation on the compressing powers. It is therefore chiefly with respect to the great wooden bellows, of which the upper board slides down between the sides, that the above calculation is of service.

The propriety, however, of this piece of information is evident: we do not know precisely the quantity of air necessary for animating a furnace; but this calculation tells us what force must be employed for expelling the air that may be thought necessary. If we have fixed on the strength of the blast, and the diameter of the cylinder, we learn the weight with which the piston must be loaded; the length of the cylinder determines its capacity, the above calculation tells the expence per second; hence we have the time of the piston's coming to the bottom. This gives us the number of strokes per minute: the load must be lifted up by the machine this number of times, making the time of ascent precisely equal to that of descent; otherwise the machine will either catch and stop the descent of the piston, or allow it to lie inactive for a while of each stroke. These circumstances determine the labour to be performed by the machine, and it must be constructed accordingly. Thus the engineer will not be affronted by its failure, nor will he expend needless power and cost.

In machines which force the piston or bellows-board with a certain determined motion, different from what arises from their own weight, the computation is extremely intricate. When a piston moves by a crank, its motion at the beginning and end of each stroke is slow, and the compression and efflux is continually changing: we can however approximate to a statement of the force required.

Every time the piston is drawn up, a certain space of the cylinder is filled again with air of the common density; and this is expelled during the descent of the piston. A certain number of cubic feet of common air is therefore expelled with a velocity which perhaps continually varies; but there is a medium velocity with which it might have been uniformly expelled, and a pressure corresponding to this velocity. To find this, divide the area of the piston by the area of the blast-hole (or rather by this area multiplied by 0.613, in order to take in the effect of the contracted jet), and multiply the length of the stroke performed in a second by the quotient arising from this division; the product is the medium velocity of the air (of the natural density). Then find by calculation the height through which a heavy body must fall in order to acquire this velocity; this is the height of a column of homogeneous air which would expel it with this velocity. The weight of this column is the least force that can be exerted by the engine: but this force is too small to overcome the resistance in the middle of the stroke, and it is too great even for the end of the stroke, and much too great for the beginning of it. But if the machine is turned by a very heavy waterwheel, this will act as a regulator, accumulating in itself the superfluous force during the too favourable positions of the crank, and exerting it by its *vis insita* during the time of greatest effort. A force not greatly exceeding the weight of this column of air will therefore suffice. On the other hand, if the strength of the blast be determined, which is the general state of the problem, this determines the degree of condensation of the air, and the load on the square inch of the piston, or the mean force which the machine must exert on it. A table, which will be given presently, determines the cubic feet of common air expelled in a second, corresponding to this load, This combined with the proposed dimensions of the cylinder, will give the descent of the piston or the length of the stroke.

These general observations apply to all forms of bellows; and without a knowledge of them no person can erect a machine for working them without total uncertainty or servile imitation. In order, therefore, that they may be useful to such as are not accustomed to the management of even these simple formulæ, we insert the following short table of the velocity and quantity of air discharged from a cylinder whose piston is loaded with the pounds contained in the first column on every square inch. The second column contains the velocity with which the *condensed air* rushes out through any *small* hole; and the third column is the cubic feet discharged from a hole whose area is a square inch; column fourth contains the mean velocity of air of the common density; and column fifth is the cubic feet of common air discharged; the sixth column is the height in inches at which the force of the blast would support a column of water if a pipe were inserted into the side of the cylinder. This is an extremely proper addition to such machines, showing at all times the power of the machines, and teaching us what intensity of blast is employed for different purposes. The table is computed from the supposition that the ordinary pressure of the air is 15 pounds on a square inch. This is somewhat too great, and therefore the velocities are a little too small; but the quantities discharged will be found about one-third too great (without affecting the velocities) on account of the convergency of the stream.

I	II	III	IV	V	VI
½	239	1.66	247	1·72	14
1	333	2·32	355	2·47	27
1½	404	2·79	437	3·05	40
2	457	3·17	518	3·60	54
2½	500	3·48	584	4·2	68
3	544	3·76	653	4·53	82
3½	582	4·03	715	4·98	95
4	611	4·24	774	5·38	109
4½	642	4·46	822	5·75	122
5	666	4·67	888	6.17	136
5½	693	4·84	950	6·49	150
6	711	5·06	997	6·92	163

This table extends far beyond the limits of ordinary use, very few blast-furnaces having a force exceeding 60 inches of water.

We shall conclude this account of blowing machines with a description of a small one for a blowpipe. ABCD, fig. 100. is a vessel containing water, about two feet deep. EFGH is the air-box of the blower open below, and having a pipe ILK rising up from it to a convenient height; an arm ON which grasps this pipe carries the lamp N: the blowpipe LM comes from the top of the upright pipe. PKQ is the feeding pipe reaching near to the bottom of the vessel. Fig. 100.

Water being poured into the vessel below, and its cover being put on, which fits the upright pipe, and touches two studs *a*, *a*, projecting from it, blow in a quantity of air by the feeding pipe PQ; this expels the water from the air box, and occasions a pressure which produces the blast through the blowpipe M.

In N° 54. of this article, we mentioned an application which has been made of Hero's fountain, at Chemnitz in Hungary, for raising water from the bottom of a mine. We shall now give an account of this very ingenious contrivance.

In fig. 101. B represents the source of water elevated above the mouth of the pit 136 feet. From this there is led a pipe B *b* CD four inches diameter. This pipe enters the top of a copper cylinder *b c d e*, 8½ feet high, five feet diameter, and two inches thick, and it reaches to within four inches of the bottom; it has a cock at C. This cylinder has a cock at F, and a very large one at E. From the top *b c* proceeds a pipe GHH′ two inches in diameter, which goes down the pit 96 feet, and is inserted into the top of another brass cylinder *f g h i*, which is 6½ feet high, four feet diameter, and two inches thick, containing 83 cubic feet, which is very nearly one half of the capacity of the other, viz. of 170 cubic feet. There is another pipe NI of four inches diameter, which rises from within four inches of the bottom of this lower cylinder, is soldered into its top, and rises to the trough NO, which carries off the water from the mouth of the pit. This lower cylinder communicates at the bottom with the water L which collects in the drains of the mine. A large cock K serves to admit or exclude this water; another cock M, at the top of this cylinder, communicates with the external air. Fig. 101.

Now suppose the cock C shut, and all the rest open; the upper cylinder will contain air, and the lower cylinder will be filled with water, because it is sunk so deep that its top is below the usual surface of the minewaters. Now shut the cocks F, E, M, K, and open the cock C. The water of the source B must run in by the orifice D, and rise in the upper cylinder, compressing the air above it and along the pipe GHH′, and thus acting on the surface of the water in the lower cylinder. It will therefore cause it to rise gradually in the pipe IN, where it will always be of such a height that its weight balances the elasticity of the compressed air. Suppose no issue given to the air from the upper cylinder, it would be compressed into one-fifth of its bulk by the column of 136 feet high; for a column of 34 feet nearly balances the ordinary elasticity of the air. Therefore, when there is an issue given to it through the pipe GHH′, it will drive the compressed air along this pipe, and it will expel water from the lower cylinder.

der. When the upper cylinder is full of water, there will be 34 cubic feet of water expelled from the lower cylinder. If the pipe IN had been more than 136 feet long, the water would have risen 136 feet, being then in equilibrio with the water in the feeding pipe B *b* CD (as was shown in N° 52.), by the intervention of the elastic air; but no more water would have been expelled from the lower cylinder than what fills this pipe. But the pipe being only 96 feet high, the water will be thrown out at N with a very great velocity. If it were not for the great obstructions which water and air must meet with in their passage along pipes, it would issue at N with a velocity of more than 50 feet per second. It issues much more slowly, and at last the upper cylinder is full of water, and the water would enter the pipe GH and enter the lower cylinder, and without displacing the air in it, would rise through the discharging pipe IN, and run off to waste. To prevent this there hangs in the pipe HG a cork ball or double cone, by a brass wire which is guided by holes in two cross pieces in the pipe HG. When the upper cylinder is filled with water, this cork plugs up the orifice G, and no water is wasted; the influx at D now stops. But the lower cylinder contains compressed air, which would balance water in a discharging pipe 136 feet high, whereas IN is only 96. Therefore the water will continue to flow at N till the air has so far expanded as to balance only 96 feet of water, that is, till it occupies one-fourth of its ordinary bulk, that is, one-fourth of the capacity of the upper cylinder, or $42\frac{1}{2}$ cubic feet. Therefore $42\frac{1}{2}$ cubic feet will be expelled, and the efflux at N will cease; and the lower cylinder is about one half full of water. When the attending workman observes this, he shuts the cock C. He might have done this before, had he known when the orifice G was stopped; but no loss ensues from the delay. At the same time the attendant opens the cock E, the water issues with great violence, being pressed by the condensed air from the lower cylinder. It therefore issues with the sum of its own weight and of this compression. These gradually decrease together, by the efflux of the water and the expansion of the air; but this efflux stops before all the water has flowed out: for there is $42\frac{1}{2}$ feet of the lower cylinder occupied by air. This quantity of water remains, therefore, in the upper cylinder nearly: the workman knows this, because the discharged water is received first of all into a vessel containing three-fourths of the capacity of the upper cylinder. Whenever this is filled, the attendant opens the cock K by a long rod which goes down the shaft; this allows the water of the mine to fill the lower cylinder, allows the air to get into the upper cylinder, and this allows the remaining water to run out of it.

And thus every thing is brought into its first condition; and when the attendant sees no more water come out at E, he shuts the cocks E and M, and opens the cock C, and the operation is repeated.

There is a very surprising appearance in the working of this engine. When the efflux at N has stopped, if the cock F be opened, the water and air rush out together with prodigious violence, and the drops of water are changed into hail or lumps of ice. It is a sight usually shown to strangers, who are desired to hold their hats to receive the blast of air: the ice comes out with such violence as frequently to pierce the hat like a pistol bullet. This rapid congelation is a remarkable instance of the general fact, that air by suddenly expanding, generates cold, its capacity for heat being increased. Thus the peasant cools his broth by blowing over the spoon, even from warm lungs: a stream of air from a pipe is always cooling.

The above account of the procedure in working this engine shows that the efflux both at N and E becomes very slow near the end. It is found convenient therefore not to wait for the complete discharges, but to turn the cocks when about 30 cubic feet of water have been discharged at N: more work is done in this way. A gentleman of great accuracy and knowledge of these subjects took the trouble, at our desire, of noticing particularly the performance of the machine He observed that each stroke, as it may be called, took up about three minutes and one-eighth; and that 32 cubic feet of water were discharged at N, and 66 were expended at E. The expence therefore is 66 feet of water falling 136 feet, and the performance is 32 raised 96, and they are in the proportion of 66×136 to 32×96, or of 1 to 0.3422, or nearly as 3 to 1. This is superior to the performance of the most perfect undershot mill, even when all friction and irregular obstructions are neglected; and is not much inferior to any overshot pump-mill that has yet been erected. When we reflect on the great obstructions which water meets with in its passage through long pipes, we may be assured that, by doubling the size of the feeder and discharger, the performance of the machine will be greatly improved; we do not hesitate to say, that it would be increased one-third: it is true that it will expend more water; but this will not be nearly in the same proportion; for most of the deficiency of the machine arises from the needless velocity of the first efflux at N. The discharging pipe ought to be 110 feet high, and not give sensibly less water.

Then it must be considered how inferior in original expence this simple machine must be to a mill of any kind which would raise 10 cubic feet 96 feet high in a minute, and how small the repairs on it need be, when compared with a mill.

And, lastly, let it be noticed, that such a machine can be used where no mill whatever can be put in motion. A small stream of water, which would not move any kind of wheel, will here raise one-third of its own quantity to the same height; working as fast as it is supplied.

For all these reasons, we think that the Hungarian machine eminently deserves the attention of mathematicians and engineers, to bring it to its utmost perfection, and into general use. There are situations where this kind of machine may be very useful. Thus, where the tide rises 17 feet, it may be used for compressing air to seven-eighths of its bulk; and a pipe leading from a very large vessel inverted in it, may be used for raising the water from a vessel of one eighth of its capacity 17 feet high; or if this vessel has only $\frac{1}{16}$ of the capacity of the large one set in the tide way, two pipes may be led from it, one into the small vessel and the other into an equal vessel 16 feet higher, which receives the water from the first. Thus one sixteenth of the water may be raised 34 feet, and a smaller quantity to a still greater height; and this with a kind of power that can hardly be applied in any other way. Machines of this kind are described by Schottus, Sturmius, Leupold, and other old writers; and they should not be forgotten, because opportunities may

Fig. 1.

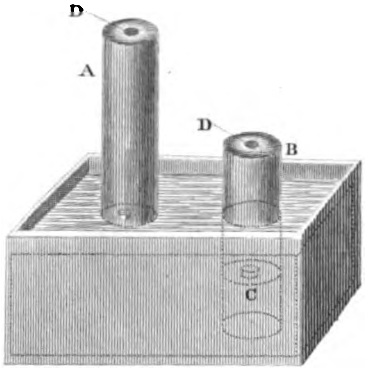
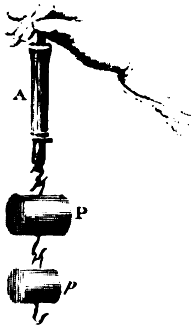


Fig 2.



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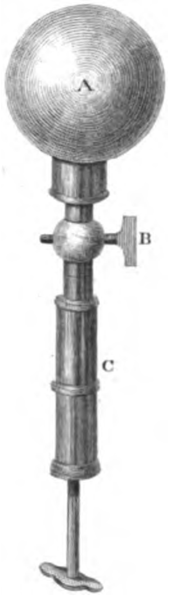

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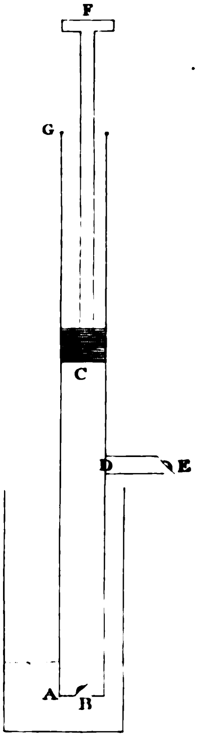

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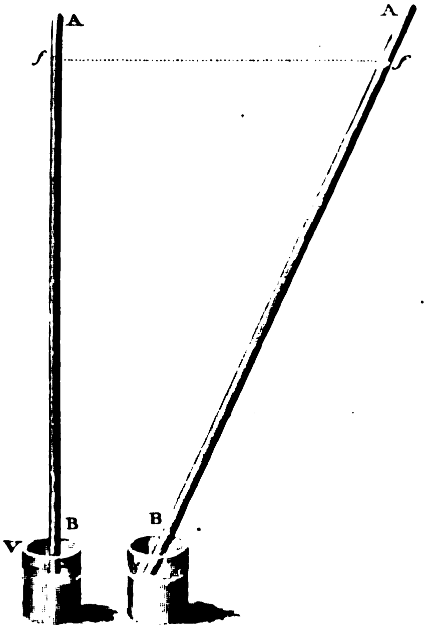

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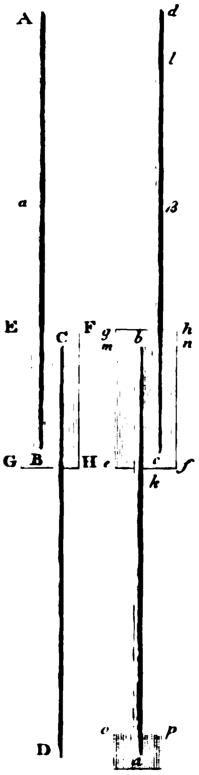

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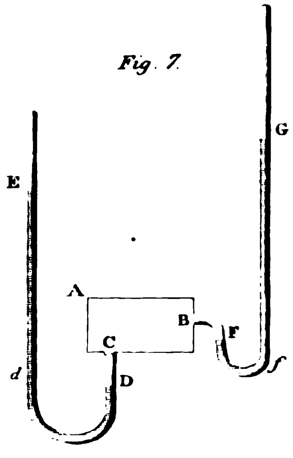

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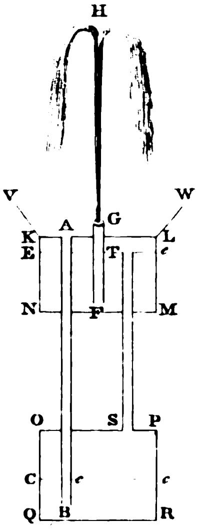

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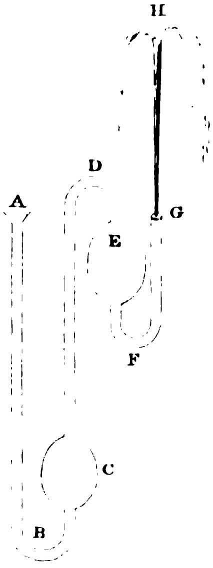
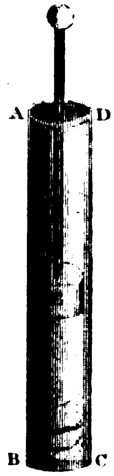


E. Mitchell sculpt.

PNEUMATICS. PLATE CCCCXXIV.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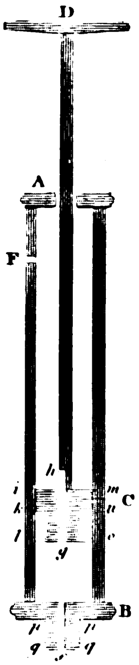
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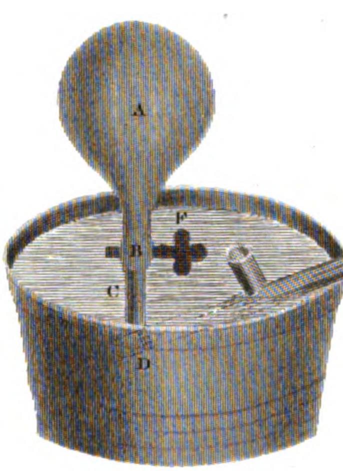
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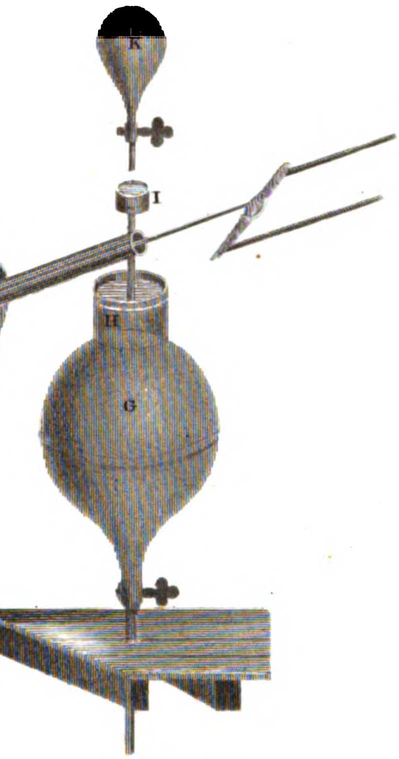
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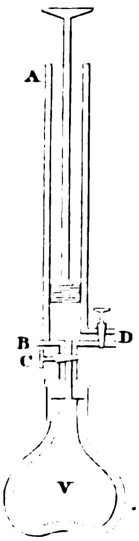
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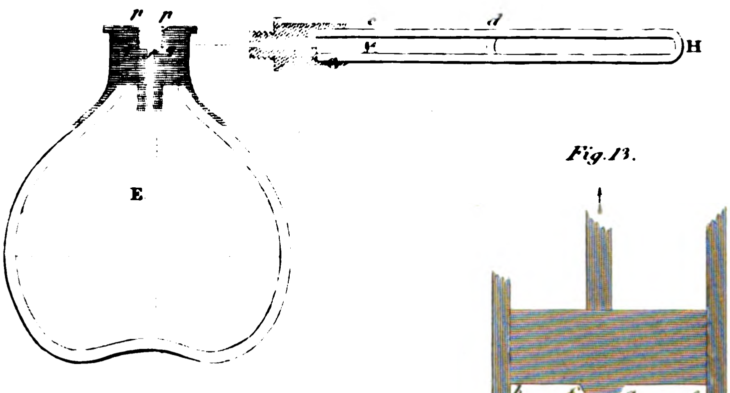

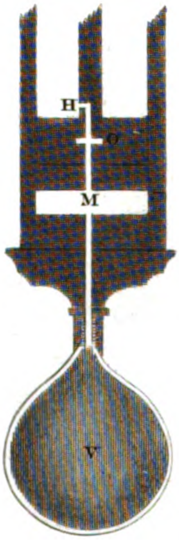
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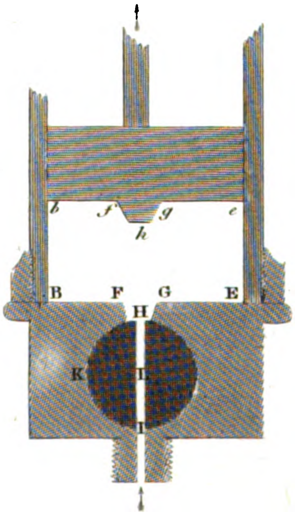
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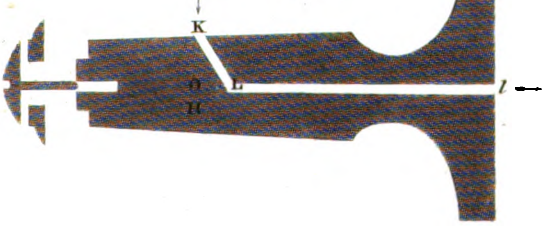
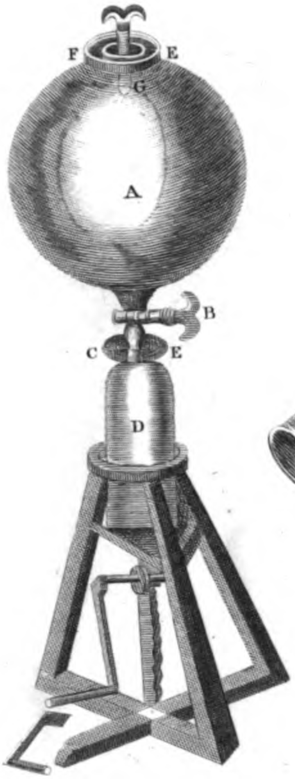


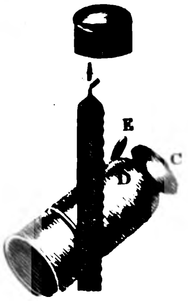
Fig. 14.

E. Mitchell sculp.t

PNEUMATICS. PLATE CCCCXXV.

Fig. 18.





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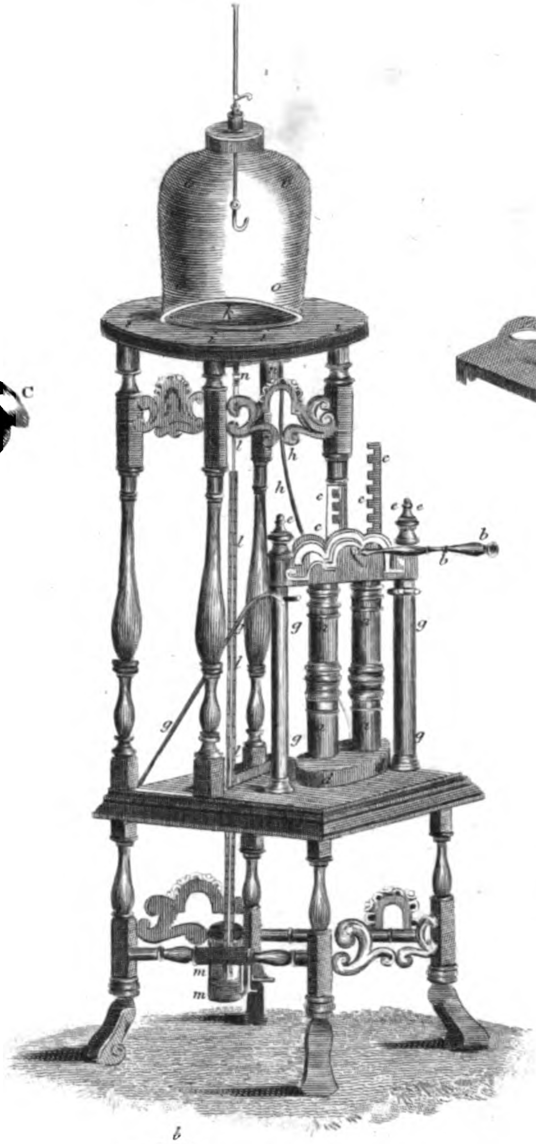

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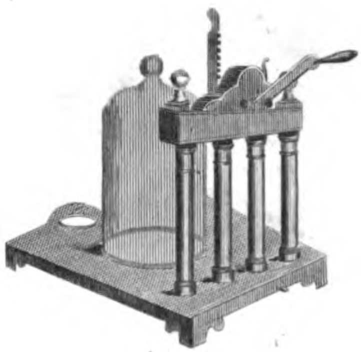

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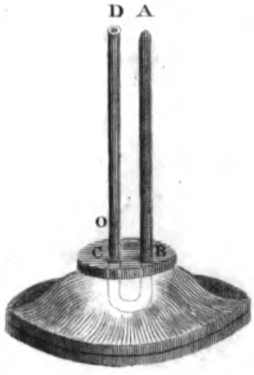

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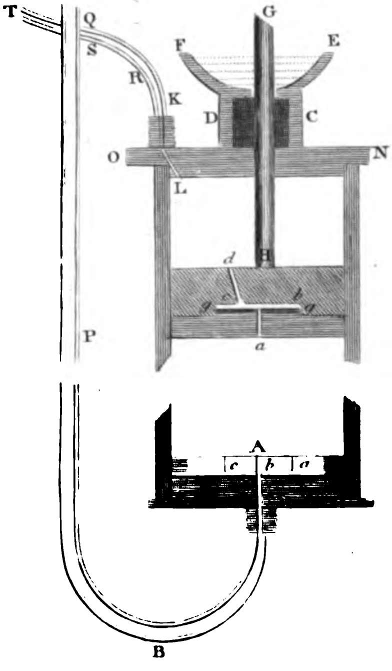

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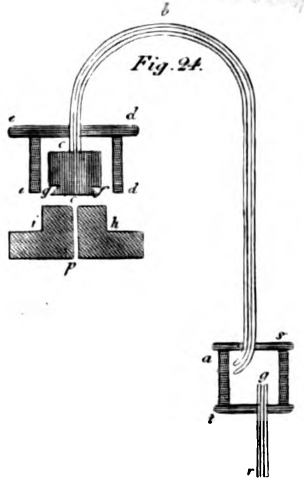

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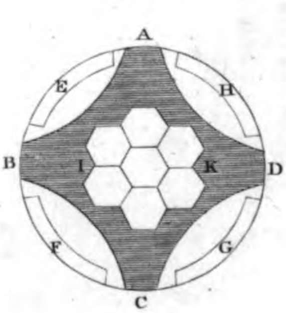

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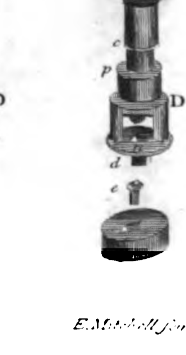
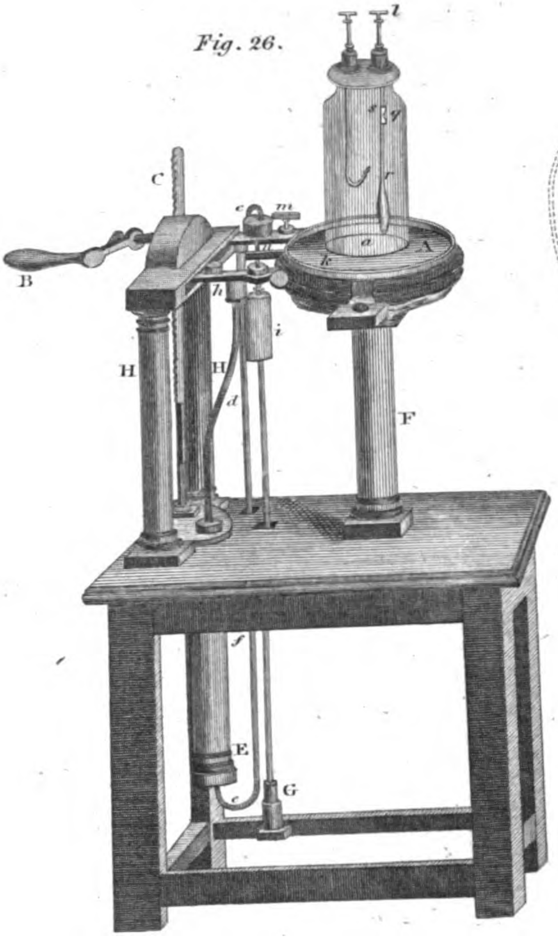


E. Mitchell Sculp.t

Fig. 26.



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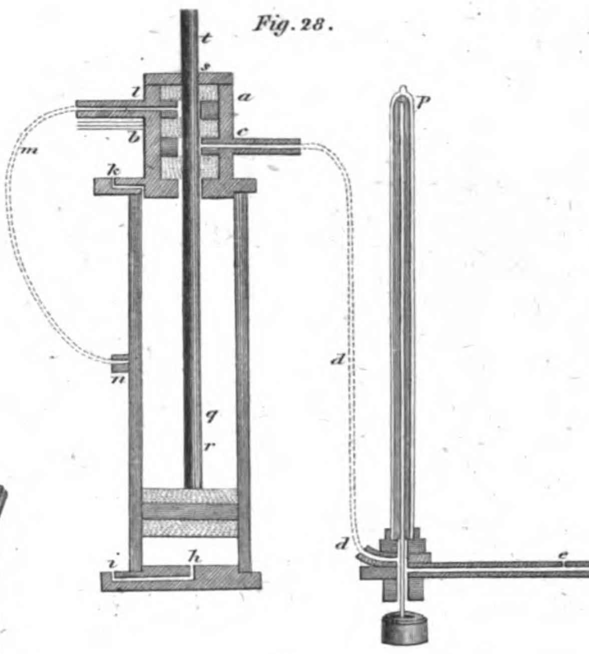

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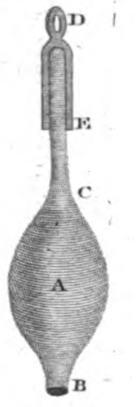

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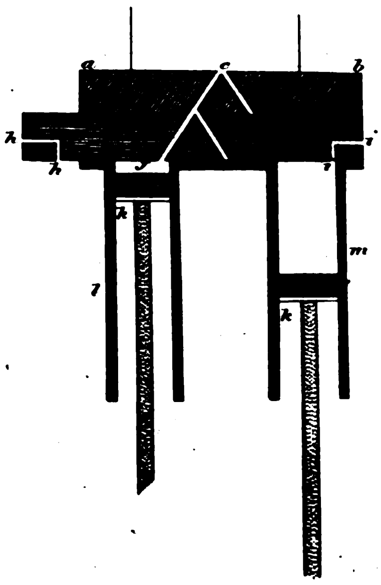

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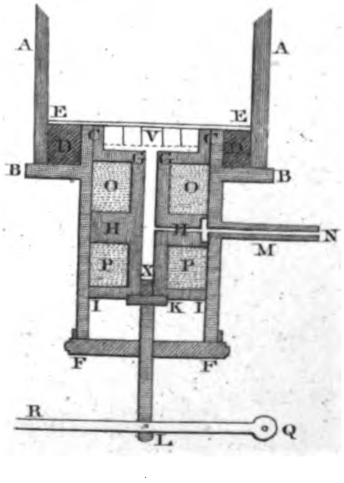

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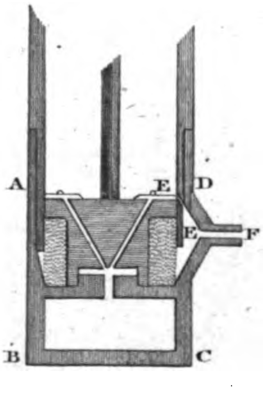


W. Archibald Sculp.

PNEUMATICS. PLATE CCCCXXVII.

Cuthbertson's Air Pump.

Fig. 32.

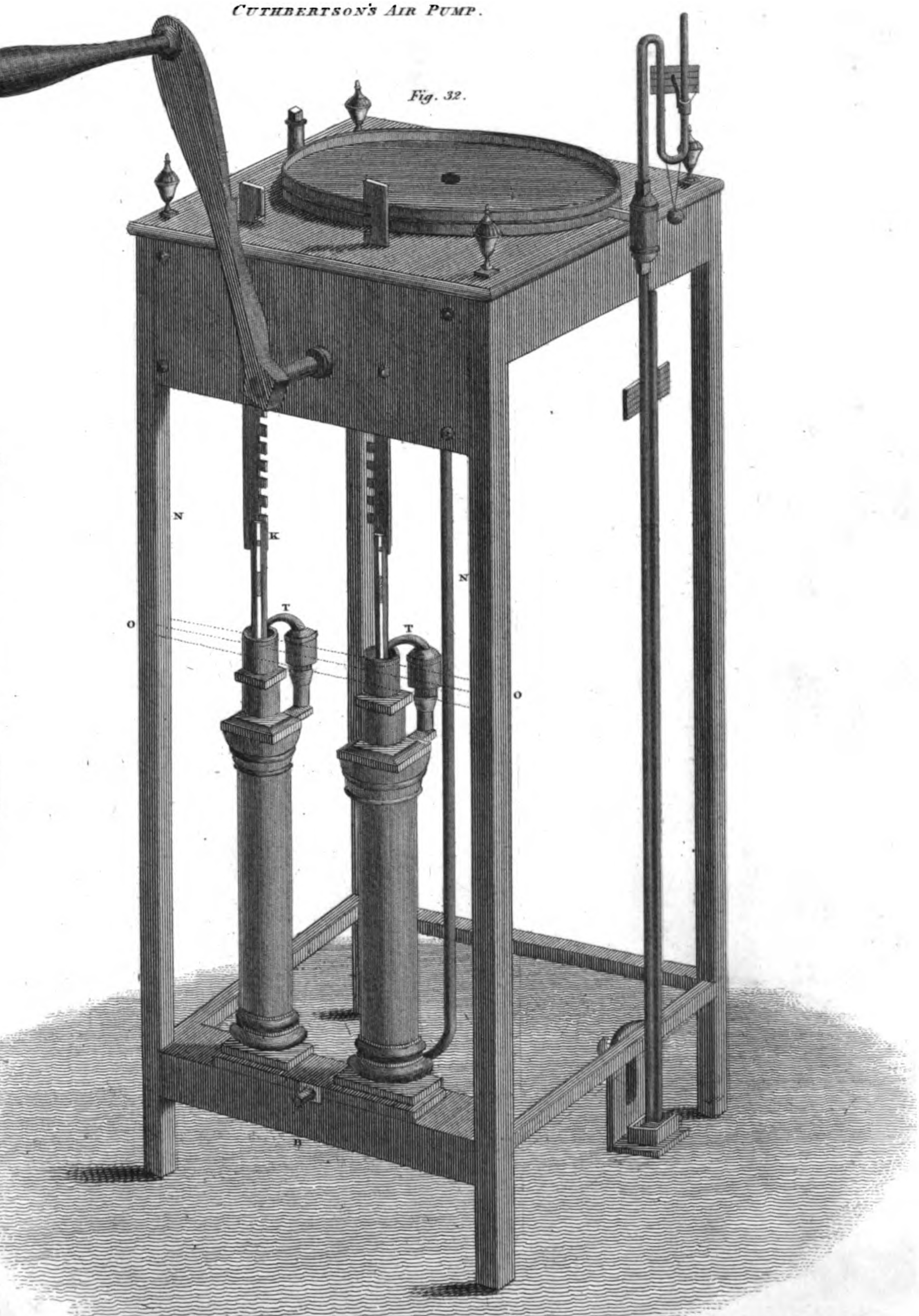
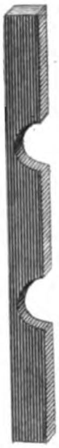
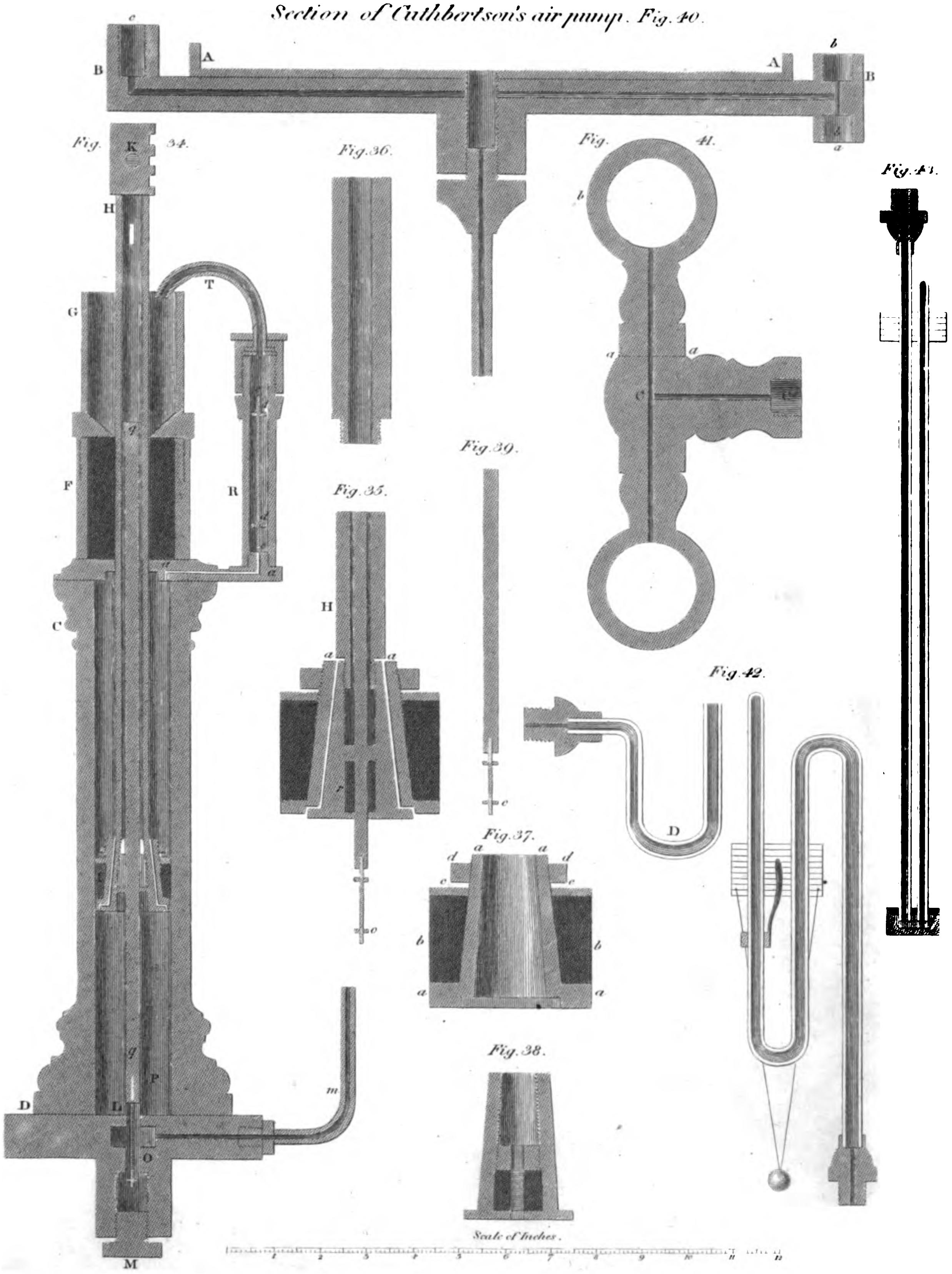


Fig. 33.



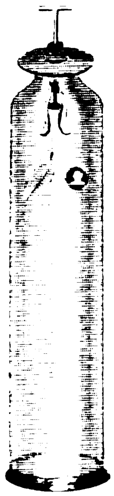
Williams Sculp.^t

PNEUMATICS. PLATE CCCCXXVIII.



E. Mitchell sculpt.

Fig. 44.



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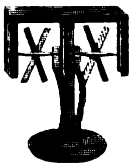
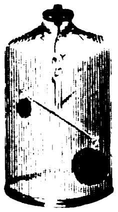


Fig. 46.



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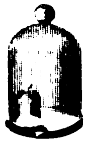

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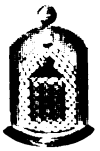

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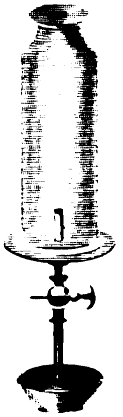

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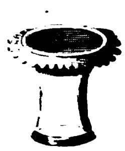

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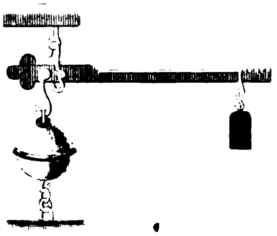

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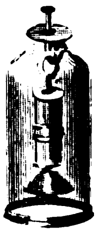

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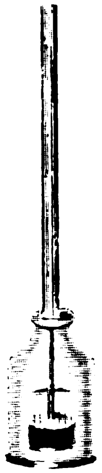

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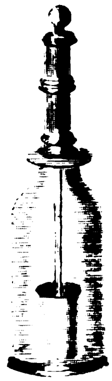

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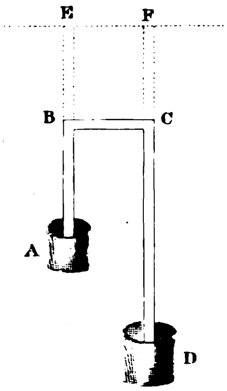

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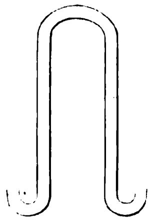

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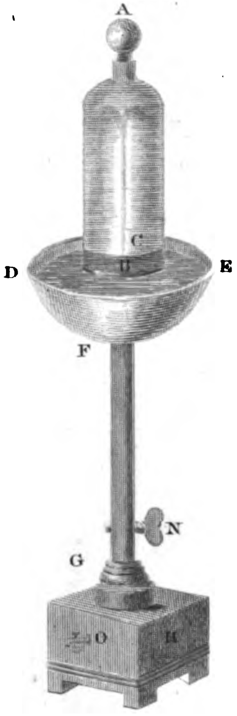

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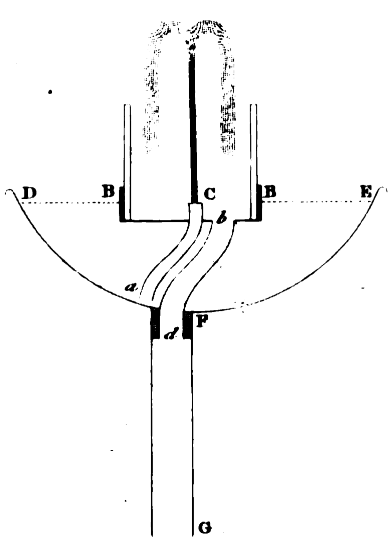

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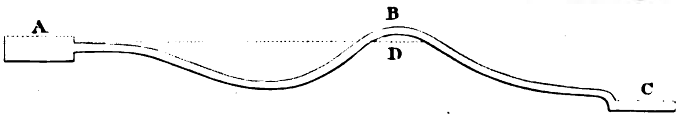


E Mitchell Sculpt

PNEUMATICS. PLATE CCCCXXX.

Fig. 60.

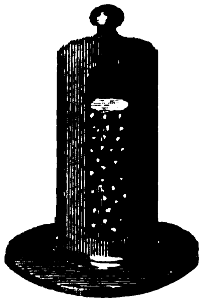
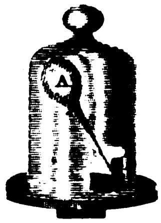


Fig. 61.



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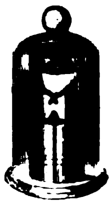

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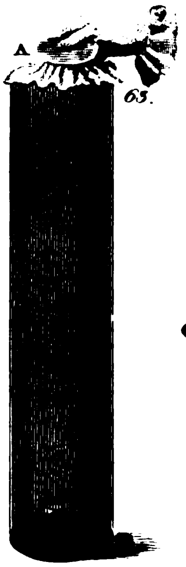

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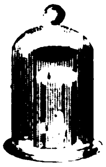

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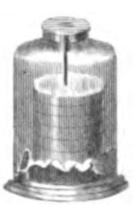

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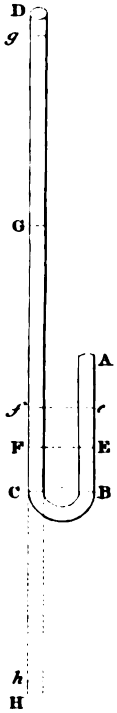

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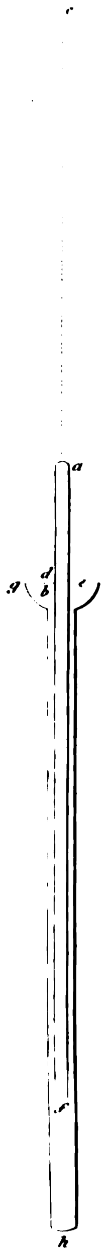

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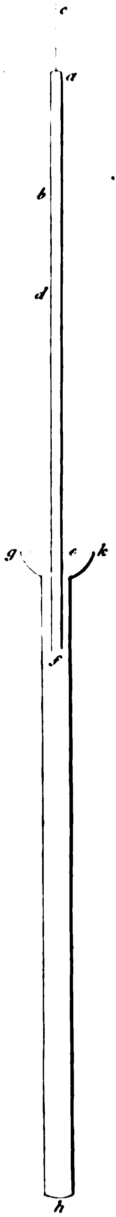

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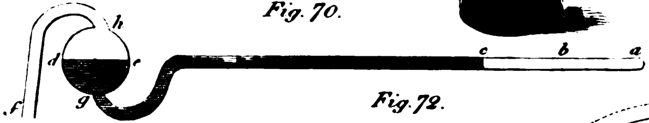

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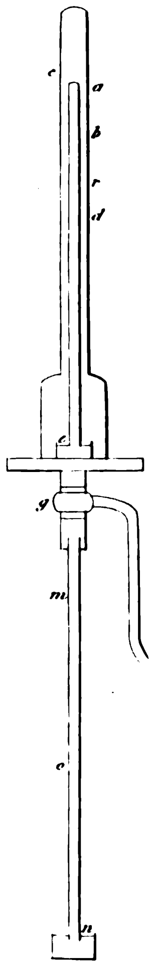

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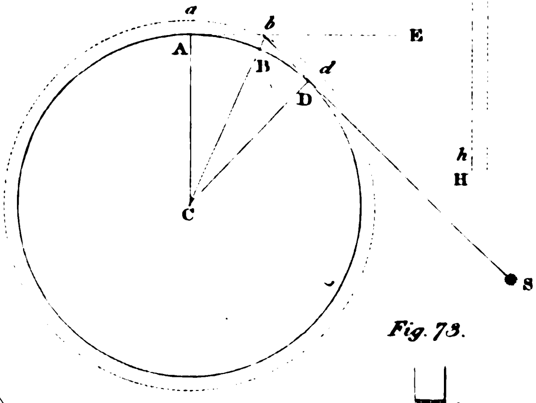

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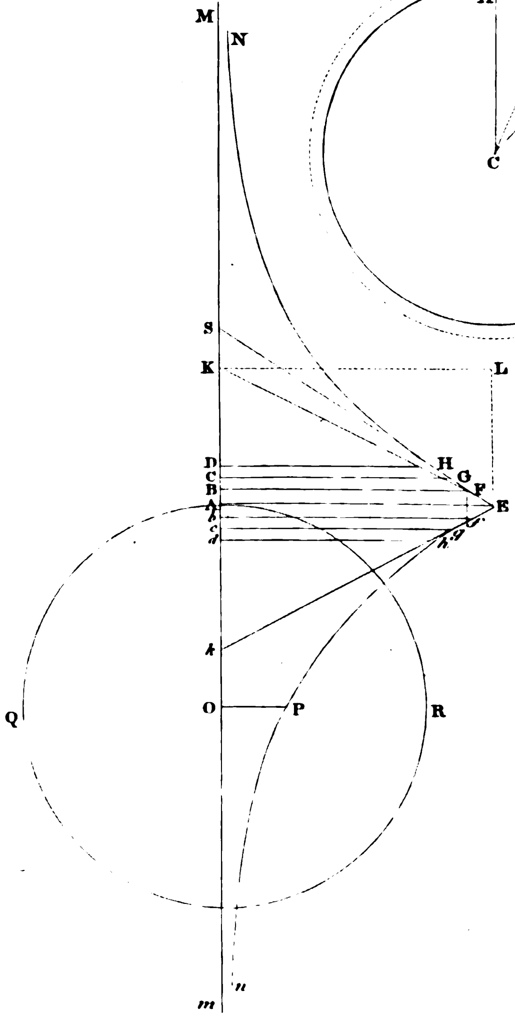

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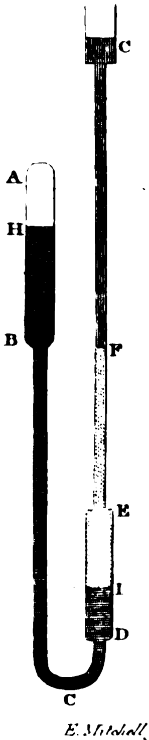
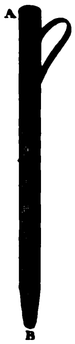


E. Mitchell sculp.t

PNEUMATICS. PLATE CCCCXXXI.

Fig. 74.



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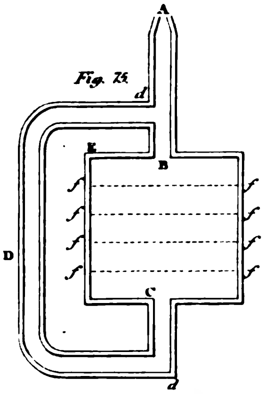

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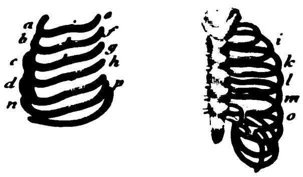

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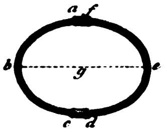

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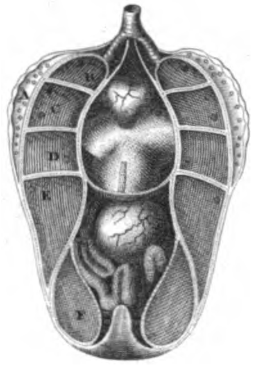

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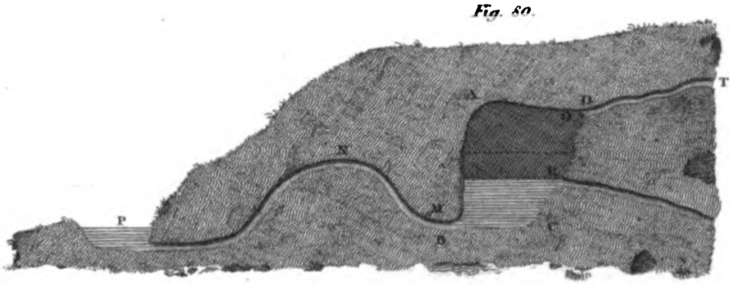

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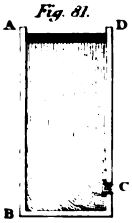

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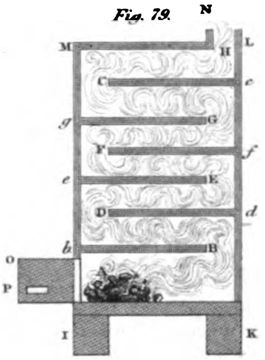

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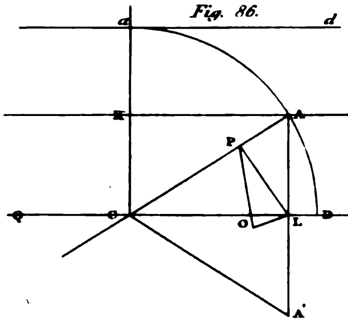

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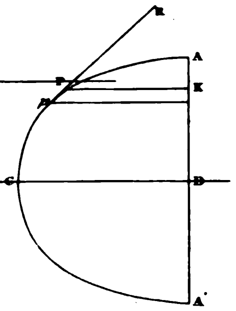

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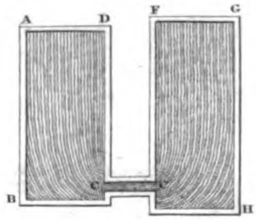
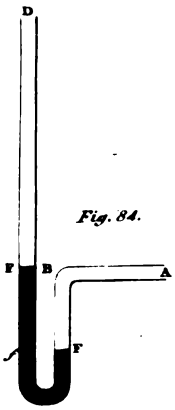


Fig. 83.

Fig. 84.



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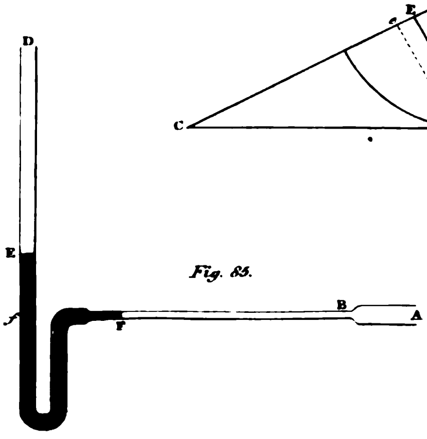

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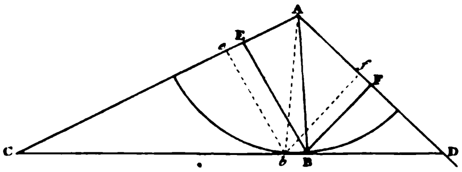
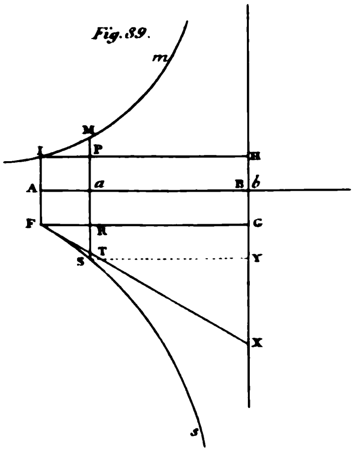
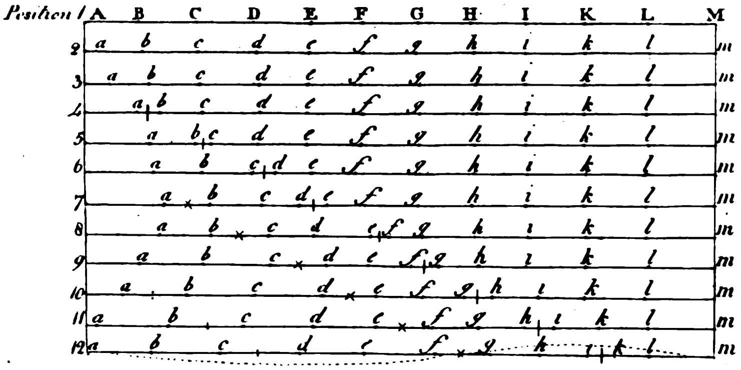


Fig. 89.



Heele sculpt.

Fig. 90.


Position 1 A B C D E F G H I K L M
2 a b c d e f g h i k l m
3 a b c d e f g h i k l m
4 a b c d e f g h i k l m
5 a b c d e f g h i k l m
6 a b c d e f g h i k l m
7 a b c d e f g h i k l m
8 a b c d e f g h i k l m
9 a b c d e f g h i k l m
10 a b c d e f g h i k l m
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12 a b c d e f g h i k l m

Fig. 91.

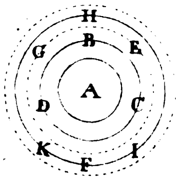


Fig. 93.

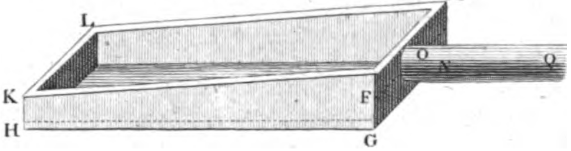


Fig. 92.

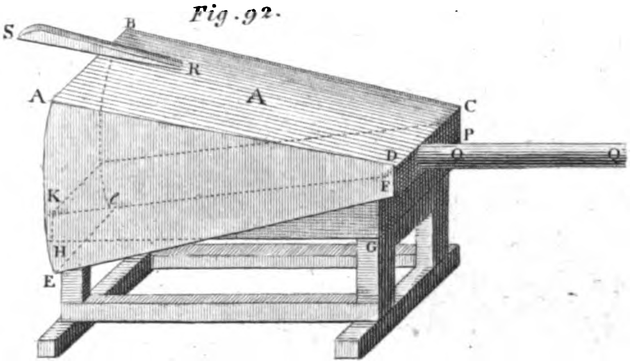


Fig. 94.

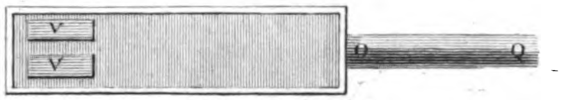


Fig. 96.

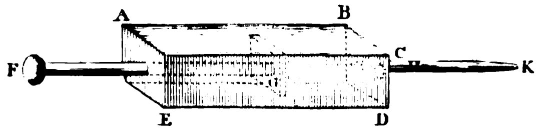


Fig. 97.

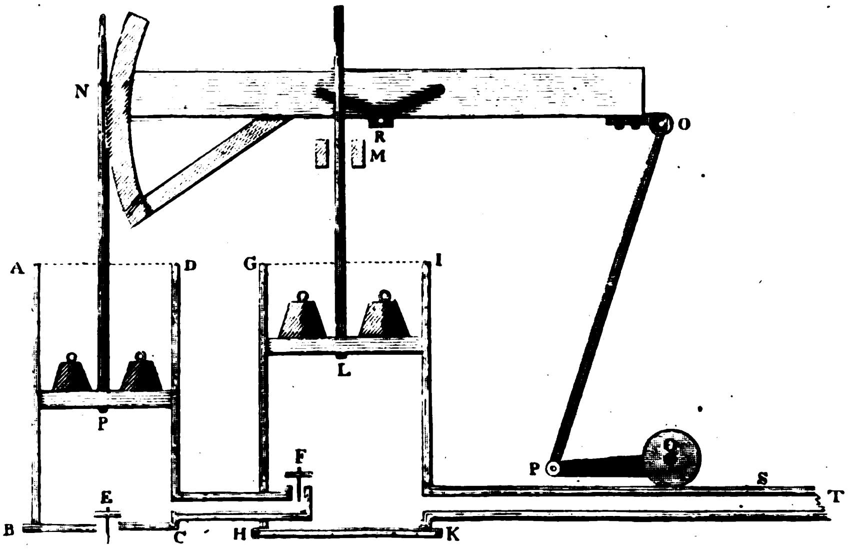
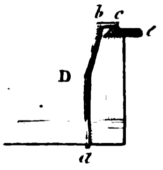


Fig. 95.



W. Archibald sculp.

Fig. 98.

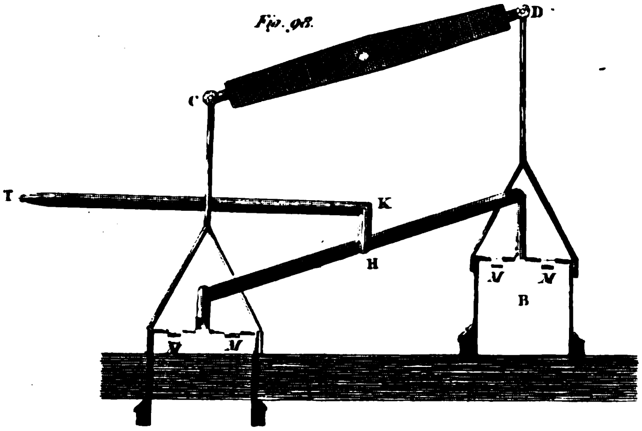
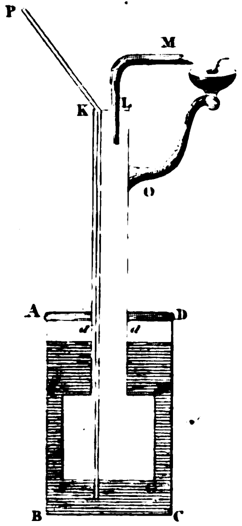


Fig. 100.



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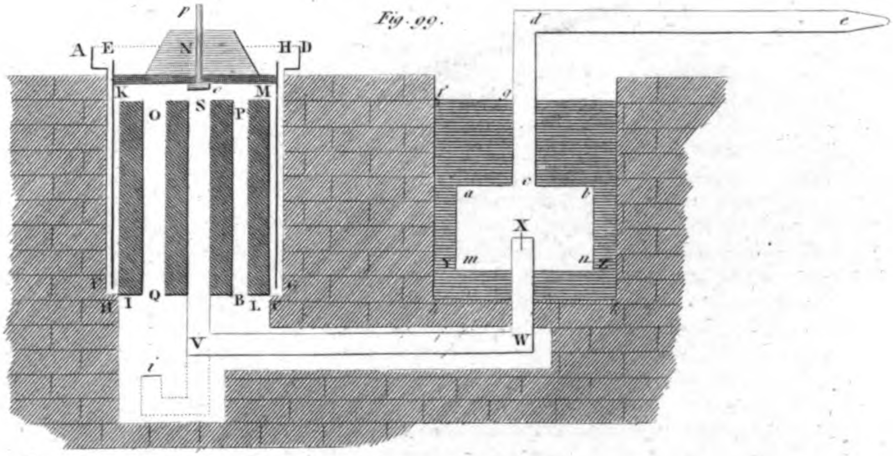


Fig. 101.

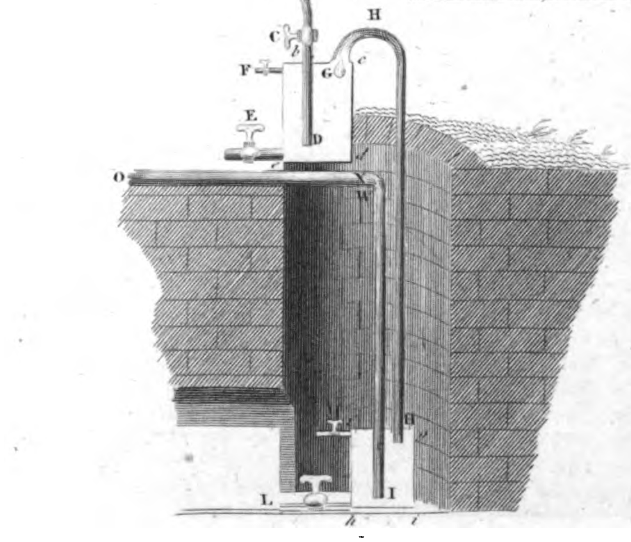
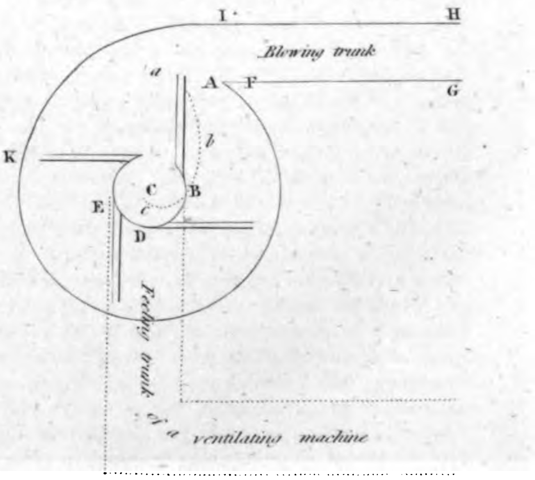


Fig. 102.



Engd by W. & D. Lizars Edinr

may offer of making them highly useful. A gentleman's house in the country may thus be supplied with water by a machine that will cost little, and hardly go out of repair.

The last pneumatical engine which we shall speak of at present is the common fanners, used for winnowing grain, and for drawing air out of a room: and we have but few observations to make on them.

Fig. 202.

The wings of the fanners are inclosed in a cylinder or drum, whose circular sides have a large opening BDE (fig. 102.) round the centre, to admit the air. By turning the wings rapidly round, the air is hurried round along with them, and thus acquires a centrifugal tendency, by which it presses strongly on the outer rim of the drum: this is gradually detached from the circle as at KI, and terminated in a trunk IHGF, which goes off in a tangential direction; the air therefore is driven along this passage.

If the wings were disposed in planes passing through the axis C, the compression of the air by the anterior surface would give it some tendency to escape in every direction, and would obstruct in some degree the arrival of more air through the side-holes. They are therefore reclined a little backward, as represented in the figure. It may be shown that their best form would be that of a hyperbolic spiral *a b c*; but the straight form approaches sufficiently near to the most perfect shape.

Much labour is lost, however, in carrying the air round those parts of the drum where it cannot escape. The fanners would either draw or discharge almost twice as much air if an opening were made all round one side. This could be gradually contracted (where required for winnowing) by a surrounding cone, and thus directed against the falling grain: this has been verified by actual trial. When used for drawing air out of a room for ventilation, it would be much better to remove the outer side of the drum entirely, and let the air fly freely off on all sides; but the flat sides are necessary, in order to prevent the air from arriving at the fanners any other way but through the central holes, to which trunks should be fitted leading to the apartment which is to be ventilated. See BAROMETER and BAROMETRICAL MEASUREMENTS, SUPPLEMENT.

PNEUMATOSIS. See MEDICINE, N° 336.

PNEUMONIA. See MEDICINE, N° 183.

PNEUMONICS, in *Pharmacy*, medicines proper in diseases of the lungs, in which respiration is affected.

PO, a large and celebrated river of Italy, which has its source at Mount Viss in Piedmont, and on the confines of Dauphiny. It runs through Piedmont, Montferrat, the Milanese, and duchy of Mantua; from thence it runs to the borders of the Parmesan, and a part of the Modenese; and having entered the Ferrarese, it begins to divide at Ficheruolo, and proceeds to discharge itself into the gulf of Venice by four principal mouths. As it passes along, it receives several rivers, and often overflows its banks, doing a great deal of mischief: the reason of which is, that most of those rivers descend from the Alps, and are increased by the melting of the snow.

POA, MEADOW-GRASS; a genus of plants belonging to the pentandria class, and in the natural method ranking under the fourth order, *Gramina*. See BOTANY and AGRICULTURE *Index*.

POCHETTI. See BARBATELLI.

POCOCKE, DR EDWARD, a learned oriental scholar, was the eldst son of the Rev. Edward Pococke; and was born at Oxford in 1604, where he was also educated. In 1628 he was admitted probationer-fellow of his college, and about the same time had prepared an edition of the Second Epistle of St Peter, the Second and Third of St John, and that of St Jude, in Syriac and Greek, with a Latin Translation and Notes. In 1629 he was ordained priest, and appointed chaplain to the English merchants at Aleppo, where he continued five or six years; in which time he distinguished himself by his fortitude and zeal while the plague raged there. At length returning to England, he was in 1636 appointed reader of the Arabic lectures founded by Archbishop Laud. Three years after he went to Constantinople, where he prosecuted his studies of the eastern tongues, and procured many valuable manuscripts. After near four years stay in that city, he embarked in 1640; and taking Paris in his way, visited Gabriel Sionita the famous Maronite, and Hugo Grotius. In 1643 he was presented to the rectory of Childrey in Berks; and about three years after married the daughter of Thomas Burdett, Esq. About the middle of 1647 he obtained the restitution of the salary of his Arabic lecture, which had been detained from him about three years. In 1648 King Charles I. who was then prisoner in the isle of Wight, nominated Mr Pococke to the professorship of Hebrew, and the canonry of Christ-church annexed to it; but in 1650 he was ejected from his canonry for refusing to take the engagement, and soon after a vote passed for depriving him of his Hebrew and Arabic lectures; but several governors of houses, &c. presenting a petition in his favour, he was suffered to enjoy both these places. He had some years before published his *Specimen Historiæ Arabum*; and now appeared his *Porta Mosis*: and soon after the English Polyglot edition of the Bible, to which he had largely contributed, and also Eutychius's Annals, with a Latin version. At the Restoration, he was restored to the canonry of Christ-church, and also received the degree of doctor of divinity. He then published his Arabic version of Grotius's Treatise of the Truth of the Christian Religion; and an Arabic poem entitled *Laimato l' Ajam*, with a Latin translation and notes. Soon after he published Gregory Abul Pharajius's *Historia Dynastiarum*. In 1674 he published an Arabic version of the chief parts of the Liturgy of the church of England; and a few years after his Commentary on the Prophecies of Micah, Malachi, Hosea, and Joel. This great man died in 1691, after having been for many years confessedly the first person in Europe for eastern learning; and was no less worthy of admiration for his uncommon modesty and humility, and all the virtues that can adorn a Christian. His theological works were republished at London in 1740, in two volumes in folio.

PODAGRA, or the GOUT. See MEDICINE, N° 211.

PODALIRIUS, son of Æsculapius and Epione, was one of the pupils of the Centaur Chiron, under whom he made himself such a master of medicine, that during the Trojan war the Greeks invited him to their camp to stop a pestilence which had baffled the skill of all their physicians. Some suppose, however, that he went to the Trojan war, not in the capacity of a physician in the Grecian army, but as a warrior, attended by his brother Machaon, in 30 ships, with soldiers from Oechalia, Ithome, and Trica. At his return Podalirius was shipwrecked on the coast of Caria, where he cured of the falling sickness a daughter of the king of the place. He fixed his habitation there; and built two towns, one of which he called *Syrna*, after his wife. The Carians, on his death, built him a temple, and paid him divine honours.

PODEX, in *Anatomy*, the same with ANUS.

PODGRAJE. See ASISIA.

PODOLIA, a province of Russian Poland, bounded on the north and north-east, by Volhinia and Kiew; on the south-east, by Cherson, and on the south-west and west, by Moldavia and Buckovina. The principal rivers are the Dneister and the Bug. This province is extremely fertile in grain, great quantities of which are conveyed by the rivers to Odessa, and thence shipped to the Mediterranean. It also abounds in cattle. The chief town is Kaminiek. In 1815, this province contained 1,181,200 inhabitants upon an area of 14,700 square miles.

PODOPHYLLUM, a genus of plants belonging to the polyandria class; and in the natural method ranking under the 27th order, *Rhœadæ*. See BOTANY *Index*.

PODURA, or SPRINGTAIL, a genus of insects of the order of aptera. See ENTOMOLOGY *Index*.

POE-BIRD is an inhabitant of some of the South sea islands, where it is held in great esteem and veneration by the natives. It goes by the name of *kogo* in New Zealand: but it is better known by that of *poë-bird*. It is somewhat less than our blackbird, and is remarkable for the sweetness of its note, as well as the beauty of its plumage. Its flesh is also delicate food.

POECILE was a famous portico at Athens, which received its name from the variety (ποικιλος) of paintings which it contained. Zeno kept his school there; and there also the stoics received their lessons, whence their name ἡ στοα, *a porch*. The Pœcile was adorned, among many others, with a picture of the siege and sacking of Troy, the battle of Theseus against the Amazons, and the fight between the Lacedæmonians and Athenians at Oenoe in Argolis. The only reward which Miltiades obtained after the battle of Marathon was to have his picture drawn more conspicuous than that of the rest of the officers that fought with him, in the representation which was made of the engagement, and which was hung up in the Pœcile in commemoration of that celebrated victory.

POEM, a poetical composition. See POETRY.

POESTUM, or POSIDONIA, an ancient city of Grecia Magna, now part of the kingdom of Naples. It was founded by one of those colonies from Greece which in the early ages established themselves in Italy; and it flourished before the foundation of Rome itself. It was destroyed by the Goths on the decline of the Roman empire, who in their barbarous zeal for the Christian religion overturned every place of Pagan worship which was exposed to their ravages. Since that time it has been in ruins; and these ruins were unknown till they were discovered in the following manner: "In the year 1755 (says the author of the *Antiquities, History, and Views of Pœstum*), an apprentice to a painter at Naples, who was on a visit to his friends at Capaccio, by accident took a walk to the mountains which surround the territory of Pœstum. The only habitation he perceived was the cottage of a farmer, who cultivated the best part of the ground, and reserved the rest for pasture. The ruins of the ancient city made a part of this view, and particularly struck the eyes of the young painter; who approaching nearer, saw with astonishment walls, towers, gates and temples. Upon his return to Capaccio, he consulted the neighbouring people about the origin of these monuments of antiquity. He could only learn, that this part of the country had been uncultivated and abandoned during their memory; that about ten years before, the farmer, whose habitation he had noticed, established himself there; and that having dug in many places, and searched among the ruins that lay round him, he had found treasures sufficient to enable him to purchase the whole. At the painter's return to Naples, he informed his master of these particulars, whose curiosity was so greatly excited by the description, that he took a journey to the place, and made drawings of the principal views. These were shown to the king of Naples, who ordered the ruins to be cleared, and Pœstum arose from the obscurity in which it had remained for upwards of 700 years, as little known to the neighbouring inhabitants as to travellers."

Our author gives the following description of it in its present state. It is, says he, of an oblong figure, about two miles and a half in circumference. It has four gates, which are opposite to each other. On the key-stone of the arch of the north gate, on the outside, is the figure of Neptune in basso relievo, and within a hippocampus. The walls which still remain are composed of very large cubical stones, and are extremely thick, in some parts 18 feet. That the walls have remained unto this time is owing to the very exact manner in which the stones are fitted to one another (a circumstance observed universally in the masonry of the ancients), and perhaps in some measure to a stalactical concretion which has grown over them. On the walls here and there are placed towers of different heights: those near the gates being much higher and larger than the others, and evidently of modern workmanship. He observes, that from its situation among marshes, bituminous and sulphureous springs, Pœstum must have been unwholesome; a circumstance mentioned by Strabo, *Morbosam eam facit fluvius in paludes diffusus*. In such a situation the water must have been bad. Hence the inhabitants were obliged to convey that necessary of life from purer springs by means of aqueducts, of which many vestiges still remain.

The principal monuments of antiquity are a theatre, an amphitheatre, and three temples. The theatre and amphitheatre are much ruined. The first temple is hexastylos, and amphiprostylos. At one end, the pilasters and two columns which divided the cella from the pronaos are still remaining. Within the cella are two rows of smaller columns, with an architrave, which support the second order. This temple our author takes to be of that kind called by Vitruvius *hyphæthros*, and supports his opinion, by a quotation from that author. The second temple is also amphiprostylos: it has nine columns in front and 18 in flank, and seems to be of that kind called by Vitruvius *pseudodipteros*. The third is likewise amphiprostylos. It has six columns in front and 13 in flank. Vitruvius calls this kind of temple *peripteros*. "The columns of these temples (says our author) are of that kind of Doric order which we find employed in works of the greatest antiquity. They are hardly five diameters in height. They are without bases, which also has been urged as a proof of their antiquity; but we do not find that the ancients ever used bases to this order, at least till very late. Vitruvius makes no mention of bases for this order: and the only instance we have of it is in the first order of the Colisæum at Rome, which was built by Vespasian. The pillars of these temples are fluted with very shallow flutings in the manner described by Vitruvius. The columns diminish from the bottom, which was the most ancient method almost universally in all the orders. The columns have astragals of a very singular form; which shows the error of those who imagine that this member was first invented with the Ionic order, to which the Greeks gave an astragal, and that the Romans were the first who applied it to the Doric. The echinus of the Capitol is of the same form with that of the temple of Corinth described by Le Roy." See *Swinburne's Travels in the Two Sicilies*, vol. ii. p. 131—140.

POET, the author of a poem. See the article POETRY.

Provençal POETS. See TROUBADOURS.

POETRY.

1 Origin of poetry.

AMIDST those thick clouds which envelope the first ages of the world, reason and history throw some lights on the origin and primitive employment of this divine art. Reason suggests, that before the invention of letters, all the people of the earth had no other method of transmitting to their descendants the principles of their worship, their religious ceremonies, their laws, and the renowned actions of their sages and heroes, than by poetry; which included all these objects in a kind of hymns that fathers sung to their children, in order to engrave them with indelible strokes in their hearts. History not only informs us, that Moses and Miriam, the first authors that are known to mankind, sung, on the borders of the Red sea, a song of divine praise, to celebrate the deliverance which the Almighty had vouchsafed to the people of Israel, by opening a passage to them through the waters; but it has also transmitted to us the song itself, which is at once the most ancient monument and a masterpiece of poetic composition.

The Greeks, a people the most ingenious, the most animated, and in every sense the most accomplished, that the world ever produced—strove to ravish from the Hebrews the precious gift of poetry, which was vouchsafed them by the Supreme Author of all nature, that they might ascribe it to their false deities. According to their ingenious fictions, Apollo became the god of poetry, and dwelt on the hills of Phocis, Parnassus and Helicon, whose feet were washed by the waters of Hippocrene, of which each mortal that ever drank was seized with a sacred delirium. The immortal swans floated on its waves. Apollo was accompanied by the Muses—those nine learned sisters—the daughters of Memory: and he was constantly attended by the Graces. Pegasus, his winged courser, transported him with a rapid flight into all the regions of the universe. Happy emblems! by which we at this day embellish our poetry, as no one has ever yet been able to invent more brilliant images.

The literary annals of all nations afford vestiges of poetry from the remotest ages. They are found among the most savage of the ancient barbarians, and the most desolate of all the Americans. Nature asserts her rights in every country and every age. Tacitus mentions the verses and the hymns of the Germans, at the time when that rough people yet inhabited the woods, and while their manners were still savage. The first inhabitants of Runnia and the other northern countries, those of Gaul, Albion, Iberia, Ausonia, and other nations of Europe, had their poetry, as well as the ancient people of Asia, and of the known borders of Africa. But the simple productions of nature have constantly something unformed, rough, and savage. The Divine Wisdom appears to have placed the ingenious and polished part of mankind on the earth, in order to refine that which comes from her bosom rude and imperfect: and thus art has polished poetry, which issued quite naked and savage from the brains of the first of mankind.

2 Definition of poetry.

But what is Poetry? It would be to abridge the limits of the poetic empire, to contract the sphere of this divine art, should we say, in imitation of all the dictionaries and other treatises on versification, That *poetry is the art of making verses, of lines or periods that are in rhyme or metre*. This is rather a grammatical explanation of the word, than a real definition of the thing, and it would be to degrade poetry thus to define it. The father of criticism has denominated poetry τεχνη μιμητικη, *an imitative art*: but this, though just in itself, is too general for a definition, as it does not discriminate poetry from other arts which depend equally on imitation. The justest definition seems to be that given by Baron Bielfield *, *That poetry is the art of expressing our thoughts by fiction*. In fact, it is after this manner (if we reflect with attention) that all the metaphors and allegories, all the various kinds of fiction, form the first materials of a poetic edifice: it is thus that all images, all comparisons, allusions, and figures, especially those which personify moral subjects, as virtues and vices, concur to the decoration of such a structure. A work, therefore, that is filled with invention, that incessantly presents images which render the reader attentive and affected, where the author gives interesting sentiments to every thing that he makes speak, and where he makes speak by sensible figures all those objects which would affect the mind but weakly when clothed in a simple prosaic style, such a work is a poem. While that, though it be in verse, which is of a didactic, dogmatic, or moral nature, and where the objects are presented in a manner quite simple, without fiction, without images or ornaments, cannot be called *poetry*, but merely a work in verse; for the art of reducing thoughts, maxims, and periods, into rhyme or metre, is very different from the art of poetry.

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* *Elem. of Univ. Erud.*

An ingenious fable, a lively and interesting romance, a comedy, the sublime narrative of the actions of a hero, such as the Telemachus of M. Fenelon, though written in prose, but in measured prose, is therefore a work of poetry: because the foundation and the superstructure are the productions of genius, as the whole proceeds from fiction; and truth itself appears to have employed an innocent and agreeable deception to instruct with efficacy. This is so true, that the pencil also, in order to please and affect, has recourse to fiction; and this part of painting is called the *poetic composition of a picture*. It is therefore by the aid of fiction that poetry, so to speak, paints its expressions, that it gives a body and a mind to its thoughts, that it animates and exalts that which would otherwise have remained arid and insensible. It is the peculiar privilege of poetry to exalt inanimate things into animals, and abstract ideas into persons. The former licence is so common, that it is now considered as nothing more than a characteristical dialect appropriated by the poets to distinguish themselves from the writers of prose; and is at the same time so essential, that we question much if this species of composition could subsist without it: for it will perhaps, upon examination, be found, that in every poetical description some of the qualities of Animal Nature are ascribed to things not having life. Every work, therefore, where the thoughts are expressed by fictions or images, is poetic; and every work where they are expressed naturally, simply, and without ornament, although it be in verse, is prosaic.

Verse, however, is not to be regarded as foreign or superfluous to poetry. To reduce those images, those fictions, into verse, is one of the greatest difficulties in poetry, and one of the greatest merits in a poem: and for these reasons, the cadence, the harmony of sounds, particularly that of rhyme, delight the ear to a high degree, and the mind insensibly repeats them while the eye reads them. There results therefore a pleasure to the mind, and a strong attachment to these ornaments: but this pleasure would be frivolous, and even childish, if it were not attended by a real utility. Verses were invented in the first ages of the world, merely to aid and to strengthen the memory: for cadence, harmony, and especially rhyme, afford the greatest assistance to the memory that art can invent; and the images, or poetic fictions, that strike our senses, assist in graving them with such deep traces in our minds, as even time itself frequently cannot efface. How many excellent apophthegms, sentences, maxims, and precepts, would have been buried in the abyss of oblivion, if poetry had not preserved them by its harmony? To give more efficacy to this lively impression, the first poets sung their verses, and the words and phrases must necessarily have been reduced, at least to cadence, or they could not have been susceptible of musical expression. One of the great excellencies, therefore, though not a necessary constituent of poetry, consists in its being expressed in verse. See Part III.

3
Verse, though not essential to poetry, one of its excellencies.

PART I. GENERAL PRINCIPLES OF THE ART.

SECT. I. *Of the Essence and End of Poetry.*

4
Essence of Poetry.

THE *essence* of *Polite Arts* in general, and consequently of poetry in particular, consists in *expression*; and we think that, to be poetic, the expression must necessarily arise from *fiction*, or invention. (See the article ART, particularly from N° 12. to the end). This invention, which is the fruit of happy genius alone, arises, 1. From the subject itself of which we undertake to treat: 2. From the manner in which we treat that subject, or the species of writing of which we make use: 3. From the plan that we propose to follow in conformity to this manner; and, 4. From the method of executing this plan in its full detail. Our first guides, the ancients, afford us no lights that can elucidate all these objects in general. The precepts which Aristotle lays down, relate to epic and dramatic poetry only: and which, by the way, confirms our idea, that antiquity itself made the essence of poetry to consist in fiction, and not in that species of verse which is destitute of it, or in that which is not capable of it. But since this art has risen to a great degree of perfection; and as poetry, like electricity, communicates its fire to every thing it touches, and animates and embellishes whatever it treats; there seems to be no subject in the universe to which poetry cannot be applied, and which it cannot render equally brilliant and pleasing. From this universality of poetry, from its peculiar property of expression by fiction, which is applicable to all subjects, have arisen its different species, of which a particular description will be given in the *second* part.

Horace, in a well-known verse, has been supposed to declare the *end* of poetry to be twofold, to please, or to instruct:

Aut prodesse volunt, aut delectare poetæ.

5
End of poetry.

But Dr Beattie * maintains, that the ultimate end of this art is to please; instruction being only one of the means (and not always a necessary one) by which that ultimate end is to be accomplished. The passage rightly understood, he observes, will not appear to contain any thing inconsistent with this doctrine. The author is there stating a comparison between the Greek and Roman writers, with a view to the poetry of the stage; and, after commending the former for their correctness, and for the liberal spirit wherewith they conducted their literary labours, and blaming his countrymen for their inaccuracy and avarice, he proceeds thus: "The ends proposed by our dramatic poets (or by poets in general) are, to please, to instruct, or to do both. When instruction is your aim, let your moral sentences be expressed with brevity, that they may be readily understood, and long remembered; where you mean to please, let your fictions be conformable to truth or probability. The elder part of your audience (or readers) have no relish for poems that give pleasure only without instruction; nor the younger for such writings as give instruction without pleasure. He only can secure the universal suffrage in his favour, who blends the useful with the agreeable, and delights at the same time that he instructs the reader. Such are the works that bring money to the bookseller, that pass into foreign countries, and perpetuate the author's name through a long succession of ages †."—Now, what is the meaning of all this? What, but that to the *perfection* of dramatic poetry (or, if you please, of poetry in general) both sound morals and beautiful fiction are requisite? But Horace never meant to say, that instruction, as well as pleasure, is necessary to give to any composition the *poetical character*; or he would not in another place have celebrated with so much affection and rapture the melting strains of Sappho, and the playful genius of Anacreon ‡,—two authors transcendently sweet, but not remarkable instructive. We are sure, that pathos, and harmony, and elevated language, were, in Horace's opinion, essential to poetry §; and of these decorations nobody will affirm that instruction is the end, who considers that the most instructive books in the world are written in plain prose.

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* *Essay on Poetry and Music*, Part i. chap. i.

† *Hor. Ar. Poet.* 333.—347.

‡ *Hor Carm.* lib. iv. ode 9.

§ *Hor. Sat.* lib. 1. sat. 4. ver. 40.

In short, our author has endeavoured by many ingenious arguments and illustrations to establish it as a truth in criticism, that the end of poetry is *to please*. Verses, if pleasing, may be poetical, though they convey little or no instruction; but verses, whose sole merit it is that they convey instruction, are not poetical. Instruction, however, he admits, especially in poems of length, is necessary to their *perfection*, because they would not be *perfectly agreeable* without it.

Sect. II. *Of the Standard of Poetical Invention.*

6
Poetical invention to be regulated

Homer's beautiful description of the heavens and earth, as they appear in a calm evening by the light of the moon and stars, concludes with this circumstance, "And the heart of the shepherd is glad *." Madame Dacier, from the turn she gives to the passage in her version, seems to think, and Pope, in order perhaps to make out his couplet, insinuates, that the gladness of the shepherd is owing to his sense of the utility of those luminaries. And this may in part be the case: but this is not in Homer; nor is it a necessary consideration. It is true, that, in contemplating the material universe, they who discern the causes and effects of things must be more rapturously entertained than those who perceive nothing but shape and size, colour and motion. Yet, in the mere outside of Nature's work, there is a splendour and a magnificence to which even untutored minds cannot attend without great delight.

* *Iliad*, viii. 555.

Beattie's Essays, Part i. chap. 2.

Not that all peasants or all philosophers are equally susceptible of these charming impressions. It is strange to observe the callousness of some men, before whom all the glories of heaven and earth pass in daily succession, without touching their hearts, elevating their fancy, or leaving any durable remembrance. Even of those who pretend to sensibility, how many are there to whom the lustre of the rising or setting sun; the sparkling concave of the midnight sky; the mountain-forest tossing and roaring to the storm, or warbling with all the melodies of a summer evening; the sweet interchange of hill and dale, shade and sunshine, grove, lawn, and water, which an extensive landscape offers to the view; the scenery of the ocean, so lovely, so majestic, and so tremendous; and the many pleasing varieties of the animal and vegetable kingdoms, could never afford so much real satisfaction, as the steams and noise of a ball-room, the insipid fiddling and squeaking of an opera, or the vexations and wranglings of a card-table!

But some minds there are of a different make; who, even in the early part of life, receive from the contemplation of Nature a species of delight which they would hardly exchange for any other, and who, as avarice and ambition are not the infirmities of that period, would, with equal sincerity and rapture, exclaim,

> I care not, Fortune, what you me deny;
> You cannot rob me of free Nature's grace;
> You cannot shut the windows of the sky,
> Through which Aurora shows her bright'ning face;
> You cannot bar my constant feet to trace
> The woods and lawns by living stream at eve.
>
> *Castle of Indolence.*

Such minds have always in them the seeds of true taste, and frequently of imitative genius. At least, though their enthusiastic or visionary turn of mind (as the man of the world would call it) should not always incline them to practise poetry or painting, we need not scruple to affirm, that without some portion of this enthusiasm no person ever became a true poet or painter. For he who would imitate the works of nature, must first accurately observe them; and accurate observation is to be expected from those only who take great pleasure in it.

To a mind thus disposed no part of creation is indifferent. In the crowded city and howling wilderness; in the cultivated province and solitary isle; in the flowery lawn and craggy mountain; in the murmur of the rivulet and in the uproar of the ocean; in the radiance of summer and gloom of winter; in the thunder of heaven and in the whisper of the breeze; he still finds something to rouze or to soothe his imagination, to draw forth his affections, or to employ his understanding. And from every mental energy that is not attended with pain, and even from some of those that are, as moderate terror and pity, a sound mind derives satisfaction; exercise being equally necessary to the body and the soul, and to both equally productive of health and pleasure.

This happy sensibility to the beauties of nature should be cherished in young persons. It engages them to contemplate the Creator in his wonderful works; it purifies and harmonizes the soul, and prepares it for moral and intellectual discipline; it supplies an endless source of amusement; it contributes even to bodily health: and, as a strict analogy subsists between material and moral beauty, it leads the heart by an easy transition from the one to the other; and thus recommends virtue for its transcendant loveliness, and makes vice appear the object of contempt and abomination. An intimate acquaintance with the best descriptive poets, Spenser, Milton, and Thomson, but above all with the divine Georgic, joined to some practice in the art of drawing, will promote this amiable sensibility in early years: for then the face of nature has novelty superadded to its other charms, the passions are not pre-engaged, the heart is free from care, and the imagination warm and romantic.

7
by the standard of nature.

But not to insist longer on those ardent emotions that are peculiar to the enthusiastic disciple of nature, may it not be affirmed of all men, without exception, or at least of all the enlightened part of mankind, that they are gratified by the contemplation of things natural, as opposed to unnatural? Monstrous sights please but for a moment, if they please at all; for they derive their charm from the beholder's amazement, which is quickly over. We read indeed of a man of rank in Sicily *, who chooses to adorn his villa with pictures and statues of most unnatural deformity: but it is a singular instance; and one would not be much more surprised to hear of a person living without food, or growing fat by the use of poison. To say of any thing, that it is *contrary to nature*, denotes censure and disgust on the part of the speaker; as the epithet *natural* intimates an agreeable quality, and seems for the most part to imply that a thing is as it ought to be, suitable to our own taste, and congenial with our own constitution. Think with what sentiments we should peruse a poem, in which nature was totally misrepresented, and principles of thought and of operation supposed to take place, repugnant to every thing we had seen or heard of:—in which, for example, avarice and coldness were ascribed to youth, and prodigality and passionate attachment to the old; in which men were made to act at random, sometimes according to character, and sometimes contrary to it; in which cruelty and envy were productive of love, and beneficence and kind affection of hatred: in which beauty was invariably the object of dislike, and ugliness of desire; in which society was rendered happy by atheism and the promiscuous perpetration of crimes, and justice and fortitude were held in universal contempt. Or think, how we should relish a painting, where no regard was had to the proportions, colours, or any of the physical laws, of Nature:—where the ears and eyes of animals were placed in their shoulders; where the sky was green and the grass crimson; where trees grew with their branches in the earth and their roots in the air; where men were seen fighting after their heads were cut off, ships sailing on the land, lions entangled in cobwebs, sheep preying on dead carcases, fishes sporting in the woods, and elephants walking on the sea. Could such figures and combinations give pleasure, or merit the appellation of sublime or beautiful? Should we hesitate to pronounce their author mad? And are the absurdities of madmen proper subjects either of amusement or of imitation to reasonable beings?

Let it be remarked, too, that though we distinguish our internal powers by different names, because otherwise we could not speak of them so as to be understood, they are all but so many energies of the same individual mind; and therefore it is not to be supposed, that what contradicts any one leading faculty should yield permanent delight to the rest. That cannot be agreeable to reason, which conscience disapproves; nor can that gratify imagination, which is repugnant to reason.——Besides, belief and acquiescence of mind are pleasant, as distrust and disbelief are painful: and therefore, that only can give solid and general satisfaction, which has something of plausibility in it; something which we conceive it possible for a rational being to believe. But no rational being can acquiesce in what is obviously contrary to nature, or implies palpable absurdity.

Poetry, therefore, and indeed every art whose end is to please, must be natural; and if so, must exhibit real matter of fact, or something like it; that is, in other words, must be either according to truth or according to verisimilitude.

And though every part of the material universe abounds in objects of pleasurable contemplation, yet nothing in nature so powerfully touches our hearts, or gives so great variety of exercise to our moral and intellectual faculties, as man. Human affairs and human feelings are universally interesting. There are many who have no great relish for the poetry that delineates only irrational or inanimate beings; but to that which exhibits the fortunes, the characters, and the conduct of men, there is hardly any person who does not listen with sympathy and delight. And hence to imitate human action, is considered by Aristotle as essential to this art; and must be allowed to be essential to the most pleasing and most instructive part of it, Epic and Dramatic composition. Mere descriptions, however beautiful, and moral reflections, however just, become tiresome, where our passions are not occasionally awakened by some event that concerns our fellow men. Do not all readers of taste receive peculiar pleasure from those little tales or episodes with which Thomson's descriptive poem on the Seasons is here and there enlivened? and are they not sensible, that the thunder-storm would not have been half so interesting without the tale of the two lovers (*Summer*, v. 1171); nor the harvest-scene, without that of Palemon and Lavinia (*Autumn*, v. 177.): nor the driving snows, without that exquisite picture of a man perishing among them (*Winter*, v. 276)? It is much to be regretted, that Young did not employ the same artifice to animate his Night-Thoughts. Sentiments and descriptions may be regarded as the pilasters, carvings, gildings, and other decorations of the poetical fabric: but human actions are the columns and the rafters that give it stability and elevation. Or, changing the metaphor, we may consider these as the soul which informs the lovely frame; while those are little more than the ornaments of the body.

Whether the pleasure we take in things natural, and our dislike to what is the reverse, be the effect of habit or of constitution, is not a material inquiry. There is nothing absurd in supposing, that between the soul, in its first formation, and the rest of nature, a mutual harmony and sympathy may have been established, which experience may indeed confirm, but no perverse habits could entirely subdue. As no sort of education could make man believe the contrary of a self-evident axiom, or reconcile him to a life of perfect solitude; so we should imagine, that our love of nature and regularity might still remain with us in some degree, though we had been born and bred in the Sicilian villa above mentioned, and never heard any thing applauded but what deserved censure, nor censured but what merited applause. Yet habit must be allowed to have a powerful influence over the

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Habit has great influence over sentiment and feeling, and of course upon poetry.

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* Brydone's Tour in Sicily, let. 24.

the sentiments and feelings of mankind; for objects to which we have been long accustomed, we are apt to contract a fondness: we conceive them readily, and contemplate them with pleasure; nor do we quit our old tracts of speculation or practice without reluctance and pain. Hence in part arises our attachment to our own professions, our old acquaintance, our native soil, our homes, and to the very hills, streams, and rocks in our neighbourhood. It would therefore be strange, if man, accustomed as he is from his earliest days to the regularity of nature, did not contract a liking to her productions and principles of operation.

9
No necessity that the poet should exactly copy nature.

Yet we neither expect nor desire, that every human invention, where the end is only to please, should be an exact transcript of real existence. It is enough, that the mind acquiesce in it as probable or plausible, or such as we think might happen without any direct opposition to the laws of nature:—Or, to speak more accurately, it is enough that it be consistent, either, first, with general experience; or, secondly, with popular opinion; or thirdly, that it be consistent with itself, and connected with probable circumstances.

First: If a human invention be consistent with *general* experience, we acquiesce in it as sufficiently probable. *Particular* experiences, however, there may be, so uncommon, and so little expected, that we should not admit their probability, if we did not know them to be true. No man of sense believes, that he has any likelihood of being enriched by the discovery of hidden treasure; or thinks it probable, on purchasing a lottery-ticket, that he shall gain the first prize; and yet great wealth has actually been acquired by such good fortune. But we should look upon these as poor expedients in a play or romance for bringing about a happy catastrophe. We expect that fiction should be more consonant to the general tenor of human affairs; in a word, that not possibility, but probability, should be the standard of poetical invention.

10
Fiction sufficiently conformable to nature when it accords with received opinions,

Secondly: Fiction is admitted as conformable to this standard, when it accords with received opinions. These may be erroneous, but are not often *apparently* repugnant to nature. On this account, and because they are familiar to us from our infancy, the mind readily acquiesces in them, or at least yields them that degree of credit which is necessary to render them pleasing: hence the fairies, ghosts, and witches of Shakespeare, are admitted as probable beings; and angels obtain a place in religious pictures, though we know that they do not now appear in the scenery of real life. A poet who should at this day make the whole action of his tragedy depend upon enchantment, and produce the chief events by the assistance of supernatural agents, would indeed be censured as transgressing the bounds of probability, be banished from the theatre to the nursery, and condemned to write fairy tales instead of tragedies. But Shakespeare was in no danger of such censures: In his days the doctrine of witchcraft was established both by law and by the fashion; and it was not only unpolite, but criminal, to doubt it. Now indeed it is admitted only by the vulgar; but it does not therefore follow that an old poem built upon it should not be acceptable to the learned themselves. When a popular opinion has long been exploded, and has become repugnant to philosophical belief, the fictions built upon it are still admitted as natural, both because we all remember to have listened to them in childhood with some degree of credit, and because we know that they were accounted natural by the people to whom they were first addressed; whose sentiments and views of things we are willing to adopt, when, by the power of pleasing description, we are introduced into their scenes, and made acquainted with their manners. Hence we admit the theology of the ancient poets, their Elysium and Tartarus, Scylla and Charybdis, Cyclops and Circe, and the rest of those "beautiful wonders" (as Horace calls them) which were believed in the heroic ages; as well as the demons and enchantments of Tasso, which may be supposed to have obtained no small degree of credit among the Italians of the 16th century, and are suitable enough to the notions that prevailed universally in Europe not long before (A). In fact, when poetry is in other respects true, when it gives an accurate display of those parts of nature about which we know that men in all ages must have entertained the same opinion, namely, those appearances in the visible creation, and those feelings and workings of the human mind, which are obvious to all mankind;—when poetry is thus far according to nature, we are very willing to be indulgent to what is fictitious in it, and to grant a temporary allowance to any system of fable which the author pleases to adopt; provided that he lay the scene in a distant country, or fix the date to a remote period. This is no unreasonable piece of complaisance; we owe it both to the poet and to ourselves; for without it we should neither form a right estimate of his genius, nor receive from his works that pleasure which they were intended to impart. Let him, however, take care, that his system of fable be such as his countrymen and cotemporaries (to whom his work is immediately addressed) might be supposed capable of yielding their assent to; for otherwise we should not believe him to be in earnest: and let him connect it as much as he can with probable circumstances, and make it appear in a series of events consistent with itself.

For (thirdly) if this be the case, we shall admit his story as probable, or at least as natural, and consequently be interested in it, even though it be not warranted by general experience, and derive but slender authority from popular opinion. Calyban, in the Tempest, would have shocked the mind as an improbability, if we had not been made acquainted with his origin, and seen his character displayed in a series of consistent behaviour. But when we are told that he sprung from a witch and a demon, a connection not contrary to the laws of nature, as they were understood in Shakespeare's time, and find his manners conformable to his descent, we are easily reconciled to the fiction. In the same sense, the Lilliputians of

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(A) In the 14th century, the common people of Italy believed that the poet Dante went down to hell; that the *Inferno* was a true account of what he saw there; and that his sallow complexion, and stunted beard (which seemed by its growth and colour to have been too near the fire), were the consequence of his passing so much of his time in that hot and smoky region. See *Vicende della Literatura del Sig. C. Denina*, cap. 4.

11
and is consistent with itself.

of Swift may pass for probable beings; not so much because we know that a belief in pigmies was once current in the world (for the true ancient pigmy was at least thrice as tall as those whom Gulliver visited), but because we find that every circumstance relating to them accords with itself, and with their supposed character. It is not the size of the people only that is diminutive; their country, seas, ships, and towns, are all in exact proportion; their theological and political principles, their passions, manners, customs, and all the parts of their conduct, betray a levity and littleness perfectly suitable: and so simple is the whole narration, and apparently so artless and sincere, that we should not much wonder if it had imposed (as we have been told it has) upon some persons of no contemptible understanding. The same degree of credit may perhaps for the same reasons be due to his giants. But when he grounds his narrative upon a contradiction to nature; when he presents us with rational brutes, and irrational men; when he tells us of horses building houses for habitation, milking cows for food, riding in carriages, and holding conversations on the laws and politics of Europe: not all his genius (and he there exerts it to the utmost) is able to reconcile us to so monstrous a fiction: we may smile at some of his absurd exaggerations; we may be pleased with the energy of style, and accuracy of description, in particular places; and a malevolent heart may triumph in the satire; but we can never relish it as a fable, because it is at once unnatural and self-contradictory. Swift's judgment seems to have forsaken him on this occasion: he wallows in nastiness and brutality: and the general run of his satire is downright defamation. Lucian's *True History*, is a heap of extravagancies put together without order or unity, or any other apparent design than to ridicule the language and manner of grave authors. His ravings, which have no better right to the name of *fable*, than a hill of rubbish has to that of palace, are destitute of every colour of plausibility. Animal trees, ships sailing in the sky, armies of monstrous things travelling between the sun and moon on a pavement of cobwebs, rival nations of men inhabiting woods and mountains in a whale's belly,—are liker the dreams of a bedlamite than the inventions of a rational being.

Beattie's Essays ut supra

12
A stricter probability requisite in some kinds of poetry than in others.

If we were to prosecute this subject any farther, it would be proper to remark, that in some kinds of poetical invention a stricter probability is required than in others:—that, for instance, Comedy, whether dramatic or narrative (B), must seldom deviate from the ordinary course of human affairs, because it exhibits the manners of real and even of familiar life:—that the tragic poet, because he imitates characters more exalted, and generally refers to events little known, or long since past, may be allowed a wider range; but must never attempt the marvellous fictions of the epic muse, because he addresses his work, not only to the passions and imagination of mankind, but also to their eyes and ears, which are not easily imposed on, and refuse to be gratified with any representation that does not come very near the truth:—that the epic poem may claim still ampler privileges, because its fictions are not subject to the scrutiny of any outward sense, and because it conveys information in regard both to the highest human characters, and the most important and wonderful events, and also to the affairs of unseen worlds and superior beings. Nor would it be improper to observe, that the several species of comic, of tragic, of epic composition, are not confined to the same degree of probability: for that farce may be allowed to be less probable than the regular comedy; the masque than the regular tragedy; and the mixed epic, such as the Fairy Queen, and Orlando Furioso, than the pure epopee of Homer, Virgil, and Milton. But this part of the subject seems not to require further illustration. Enough has been said to show, that nothing unnatural can please; and that therefore poetry, whose end is to please, must be *according to nature*.

And if so, it must be either according to real nature, or according to nature somewhat different from the reality.

SECT. III. *Of the System of Nature exhibited by Poetry.*

13
Historians embellish their works by fiction, and make them

To exhibit *real nature* is the business of the historian; who, if he were strictly to confine himself to his own sphere, would never record even the minutest circumstance of any speech, event, or description, which was not warranted by sufficient authority. It has been the language of critics in every age, that the historian ought to relate nothing as true which is false or dubious, and to conceal nothing material which he knows to be true. But it is to be doubted whether any writer of profane history has ever been so scrupulous. Thucydides himself, who began his history when that war began which he records, and who set down every event soon after it happened, according to the most authentic information, seems, however, to have indulged his fancy not a little in his harangues and descriptions, particularly that of the plague of Athens: and the same thing has been practised, with greater latitude, by Livy and Tacitus, and more or less by all the best historians both ancient and modern. Nor are they to be blamed for it. By these improved or invented speeches, and by the heightenings thus given to their descriptions, their work becomes more interesting, and more useful; nobody is deceived, and historical truth is not materially affected. A medium is, however, to be observed in this, as in other things. When the historian lengthens a description into a detail of fictitious events, as Voltaire has done in his account of the battle of Fontenoy, he loses his credit with us, by raising a suspicion that he is more intent upon a pretty story than upon the truth. And we are disgusted with his insincerity, when, in defiance even of verisimilitude, he puts long elaborate orations in the mouth of those, of whom we know, either from the circumstances that they could not, or from more authentic records that they did not, make any such orations; as Dionysius of Halicarnassus has done in the case of Volumnia haranguing her son Coriolanus, and Flavius Josephus in that of Judah addressing his brother as viceroy of Egypt. From what these historians relate, one would conjecture

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(B) Fielding's *Tom Jones*, *Amelia*, and *Joseph Andrews*, are examples of what may be called the *Epic or Narrative Comedy*, or more properly perhaps the *Comic Epopee*.

conjecture that the Roman matron had studied at Athens under some long-winded rhetorician, and that the Jewish patriarch must have been one of the most flowery orators of antiquity. But the fictitious part of history, or of story-telling, ought never to take up much room; and must be highly blameable when it leads into any mistake either of facts or of characters.

14
In some degree poetical.

Now why do historians take the liberty to embellish their works in this manner? One reason, no doubt, is, that they may display their talents in oratory and narration: but the chief reason, as hinted already, is, to render their composition more agreeable. It would seem, then, that something more pleasing than real nature, or something which shall add to the pleasing qualities of real nature, may be devised by human fancy. And this may certainly be done. And this it is the poet's business to do. And when this is in any degree done by the historian, his narrative becomes in that degree poetical.

Beattie's Essays, chap. ii.

The possibility of thus improving upon nature must be obvious to every one. When we look at a landscape, we can fancy a thousand additional embellishments. Mountains loftier and more picturesque; rivers more copious, more limpid, and more beautifully winding; smoother and wider lawns; valleys more richly diversified; caverns and rocks more gloomy and more stupendous; ruins more majestic; buildings more magnificent; oceans more varied with islands, more splendid with shipping, or more agitated by storm, than any we have ever seen—it is easy for human imagination to conceive. Many things in art and nature exceed expectation; but nothing sensible transcends or equals the capacity of thought:—a striking evidence of the dignity of the human soul! The finest woman in the world appears to every eye susceptible of improvement, except perhaps to that of her lover. No wonder, then, if in poetry events can be exhibited more compact, and of more pleasing variety, than those delineated by the historian, and scenes of inanimate nature more dreadful or more lovely, and human characters more sublime and more exquisite, both in good and evil.

15
Poets embellish nature itself.

Yet still let nature supply the ground-work and materials, as well as the standard, of poetical fiction. The most expert painters use a layman, or other visible figure, to direct their hand and regulate their fancy. Homer himself founds his two poems on authentic tradition; and tragic as well epic poets have followed the example. The writers of romance, too, are ambitious to interweave true adventure with their fables; and when it can be conveniently done, to take the outlines of their plan from real life. Thus the tale of Robinson Crusoe is founded on an incident that actually befel one Alexander Selkirk, a seafaring man, who lived several years alone in the island of Juan Fernandes: Smollet is thought to have given us several of his own adventures in the history of Roderic Random; and the chief characters in Tom Jones, Joseph Andrews, and Pamela, are said to have been copied from real originals. Dramatic comedy, indeed, is for the most part purely fictitious; for if it were to exhibit real events as well as present manners, it would become too personal to be endured by a well-bred audience, and degenerate into downright abuse; which appears to have been the case with the old comedy of the Greeks *. But in general, hints taken from real existence will be found to give no little grace and stability to fiction, even in the most fanciful poem. These hints, however, may be improved by the poet's imagination, and set off with every probable ornament that can be devised, consistently with the design and genius of the work; or in other words, with the sympathies that the poet means to awaken in the mind of his reader. For mere poetical ornament, when it fails to interest the affections, is not only useless, but improper; all true poetry being directed to the heart, and intended to give pleasure by raising or soothing the passions;—the only effectual way of pleasing a rational and moral creature. And therefore we would take Horace's maxim to be universal in poetry: "*Non satis est, pulchra esse poemata;* dulcia *sunto:*" "It is not enough that poems be beautiful; let them also be *affecting*:"—For that this is the meaning of the word *dulcia* in this place, is admitted by the best interpreters, and is indeed evident from the context †.

16
and describe even things inanimate so as to make them affecting.

That the sentiments and feelings of percipient beings when expressed in poetry, should call forth our affections, is natural enough; but can descriptions of inanimate things also be made affecting? Certainly they can: and the more they affect, the more they please us, and the more poetical we allow them to be. Virgil's Georgic is a noble specimen (and indeed the noblest in the world) of this sort of poetry. His admiration of external nature gains upon a reader of taste, till it rise to perfect enthusiasm. The following observations will perhaps explain this matter.

Every thing in nature is complex in itself, and bears innumerable relations to other things; and may therefore be viewed in an endless variety of lights, and consequently described in an endless variety of ways. Some descriptions are good, and others bad. An historical description, that enumerates all the qualities of any object, is certainly good because it is true; but may be as unaffecting as a logical definition. In poetry, no unaffecting description is good, however conformable to truth: for here we expect not a complete enumeration of qualities (the chief end of the art being to please), but only such an enumeration as may give a lively and interesting idea. It is not memory, or the knowledge of rules, that can qualify a poet for this sort of description; but a peculiar liveliness of fancy and sensibility of heart, the nature whereof we may explain by its effects, but we cannot lay down rules for the attainment of it.

When our mind is occupied by any emotion, we naturally use words and meditate on things that are suitable to it and tend to encourage it. If a man were to write a letter when he is very angry, there would probably be something of vehemence or bitterness in the style, even though the person to whom he wrote were not the object of his anger. The same thing holds true of every other strong passion or emotion:—while it predominates in the mind, it gives a peculiarity to our thoughts, as well as to our voice, gesture, and countenance: and hence we expect, that every personage introduced in poetry should see things through the medium of his ruling passion, and that his thoughts and language should be tinctured accordingly.

17
Every person introduced in poetry should see things through the medium of his ruling passion.

A melancholy man walking in a grove, attends to those things that suit and encourage his melancholy; the sighing of the wind in the trees, the murmuring of waters, the darkness and solitude of the shades: A cheerful man in

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* Compare or. lib. i. at. 4 vers. —5 with r. *Poet.* ers, 281. -285.

† *Hor. Ar. Poet.* vers. 95.—100.

Of Nature in Poetry.

the same place, finds many subjects of cheerful meditations, in the singing of birds, the brisk motions of the babbling stream, and the liveliness and variety of the verdure. Persons of different characters, contemplating the same thing, a Roman triumph, for instance, feel different emotions, and turn their view to different objects. One is filled with wonder at such a display of wealth and power; another exults in the idea of conquest, and pants for military renown; a third, stunned with clamour, and harassed with confusion, wishes for silence, security, and solitude; one melts with pity to the vanquished, and makes many a sad reflection upon the insignificance of worldly grandeur, and the uncertainty of human things; while the buffoon, and perhaps the philosopher, considers the whole as a vain piece of pageantry, which, by its solemn procedure, and by the admiration of so many people, is only rendered the more ridiculous:—and each of these persons would describe it in a way suitable to his own feelings, and tending to raise the same in others. We see in Milton's Allegro and Penseroso, how a different cast of mind produces a variety in the manner of conceiving and contemplating the same rural scenery. In the former of these excellent poems, the author personates a cheerful man, and takes notice of those things in external nature that are suitable to cheerful thoughts, and tend to encourage them: in the latter, every object described is serious and solemn, and productive of calm reflection and tender melancholy; and we should not be easily persuaded, that Milton wrote the first under the influence of sorrow, or the second under that of gladness. We often see an author's character in his works; and if every author were in earnest when he writes, we should oftener see it. Thomson was a man of piety and benevolence, and a warm admirer of the beauties of nature; and every description in his delightful poem on the Seasons tends to raise the same laudable affections in his reader. The parts of nature that attract his notice are those which an impious or hard-hearted man would neither attend to, nor be affected with, at least in the same manner. In Swift we see a turn of mind very different from that of the amiable Thomson; little relish for the sublime or beautiful, and a perpetual succession of violent emotions. All his pictures of human life seem to show, that deformity and meanness were the favourite objects of his attention, and that his soul was a constant prey to indignation (c), disgust, and other gloomy passions, arising from such a view of things. And it is the tendency of almost all his writings (though it was not always the author's design), to communicate the same passions to his reader: insomuch, that notwithstanding his erudition and knowledge of the world, his abilities as a popular orator and man of business, the energy of his style, the elegance of some of his verses, and his extraordinary talents in wit and humour, there is reason to doubt, whether by studying his works any person was very much improved in piety or benevolence.

Beattie's Essays, ut supra.

And thus we see, how the compositions of an ingenious author may operate upon the heart, whatever be the subject. The affections that prevail in the author himself, direct his attention to objects congenial, and give a peculiar bias to his inventive powers, and a peculiar colour to his language. Hence his work, as well as face, if nature is permitted to exert herself freely in it, will exhibit a picture of his mind, and awaken correspondent sympathies in the reader. When these are favourable to virtue, which they always ought to be, the work will have that sweet pathos to which Horace alludes in the passage above mentioned; and which we so highly admire, and so warmly approve, even in those parts of the Georgic that describe inanimate nature.

Of Nature in Poetry.

18
It is thus that poetry affects the heart whatever be its subject.

Horace's account of the matter in question differs not from what is here given. "It is not enough (says he*) that poems be beautiful; let them be affecting, and agitate the mind with whatever passions the poet wishes to impart. The human countenance, as it smiles on those who smile, accompanies also with sympathetic tears those who mourn. If you would have me weep, you must first weep yourself; then, and not before, shall I be touched with your misfortunes.—For nature first makes the emotions of our mind correspond with our circumstances, infusing real joy, sorrow, or resentment, according to the occasion; and afterwards gives the true pathetic utterance to the voice and language." This doctrine, which concerns the orator and the player no less than the poet, is strictly philosophical, and equally applicable to dramatic, to descriptive, and indeed to every species of interesting poetry. The poet's sensibility must first of all engage him warmly in his subject, and in every part of it; otherwise he will labour in vain to interest the reader. If he would paint external nature, as Virgil and Thomson have done, so as to make her amiable to others, he must first be enamoured of her himself; if he would have his heroes and heroines speak the language of love or sorrow, devotion or courage, ambition or anger, benevolence or pity, his heart must be susceptible of these emotions, and in some degree feel them, as long at least as he employs himself in framing words for them; being assured, that

> He best shall paint them who can feel them most.
>
> POPE'S *Eloisa*, v. 366.

19
The true poet must possess fancy to invent decorations to nature.

The true poet, therefore, must not only study nature, and know the reality of things, but must also possess fancy, to invent additional decorations; judgment, to direct him in the choice of such as accord with verisimilitude; and sensibility, to enter with ardent emotions into every part of his subject, so as to transfuse into every part of his work a pathos and energy sufficient to raise corresponding emotions in the reader.

"The historian and the poet (says Aristotle*) differ in this, that the former exhibits things as they are, the latter as they might be;"—*i. e.* in that state of perfection which is consistent with probability, and in which, for the sake of our own gratification, we wish to find them. If the poet, after all the liberties he is allowed to take with the truth, can produce nothing more exquisite than is commonly to be met with in history, his reader will be disappointed and dissatisfied. Poetical representations must therefore be framed after a pattern of the highest probable perfection that the genius of the work will admit:—external nature must in them be more picturesque than in reality; action more animated; sentiments more expressive of the feelings and character, and more suitable to the circumstances of the speaker; personages better accomplished in those qualities that raise admiration, pity, terror, and other ardent emotions; and events more compact, more clearly connected with causes and consequences, and unfolded in an order more flattering to the fancy, and more interesting to the passions. But where, it may be said, is this pattern of perfection to be found? Not in real nature; otherwise history, which delineates real nature, would also delineate this pattern of perfection. It is to be found only in the mind of the poet; and it is imagination, regulated by knowledge, that enables him to form it.

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* *Ar. Poet.* v. 95—111.

* *Poetic.* sect. 9.

(c) For part of this remark we have his own authority, often in his letters, and very explicitly in the Latin epitaph which he composed for himself:—"ubi sæva indignatio ulterius cor lacerare nequit." *See his last will and testament.*

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In the beginning of life, and while experience is confined to a small circle, we admire every thing, and are pleased with very moderate excellence. A peasant thinks the hall of his landlord the finest apartment in the universe, listens with rapture to the strolling ballad-singer, and wonders at the rude wooden cuts that adorn his ruder compositions. A child looks upon his native village as a town; upon the brook that runs by as a river; and upon the meadows and hills in the neighbourhood as the most spacious and beautiful that can be. But when, after long absence, he returns in his declining years, to visit, once before he die, the dear spot that gave him birth, and those scenes whereof he remembers rather the original charms than the exact proportions; how is he disappointed to find every thing so debased and so diminished! The hills seem to have sunk into the ground, the brook to be dried up, and the village to be forsaken of its people; the parish-church, stripped of all its fancied magnificence, is become low, gloomy, and narrow; and the fields are now only the miniature of what they were. Had he never left this spot, his notions might have remained the same as at first; and had he travelled but a little way from it, they would not perhaps have received any material enlargement. It seems then to be from observation of many things of the same or similar kinds, that we acquire the talent of forming ideas more perfect than the real objects that lie immediately around us: and these ideas we may improve gradually more and more, according to the vivacity of our mind, and extent of our experience, till at last we come to raise them to a degree of perfection superior to any thing to be found in real life. There cannot sure be any mystery in this doctrine; for we think and speak to the same purpose every day. Thus nothing is more common than to say, that such an artist excels all we have ever known in his profession, and yet that we can still conceive a superior performance. A moralist, by bringing together into one view the separate virtues of many persons, is enabled to lay down a system of duty more perfect than any he has ever seen exemplified in human conduct. Whatever be the emotion the poet intends to raise in his reader, whether admiration or terror, joy or sorrow; and whatever be the object he would exhibit, whether Venus or Tisiphone, Achilles or Thersites, a palace or a pile of ruins, a dance or a battle; he generally copies an idea of his own imagination; considering each quality as it is found to exist in several individuals of a species, and thence forming an assemblage more or less perfect in its kind, according to the purpose to which he means to apply it.

21
poetical conceptions must be general,

Hence it would appear, that the ideas of poetry are rather general than singular; rather collected from the examination of a species or class of things, than copied from an individual. And this, according to Aristotle, is in fact the case, at least for the most part; whence that critic determines, that poetry is something more exquisite and more philosophical than history *. The historian may describe Bucephalus, but the poet delineates a war-horse; the former must have seen the animal he speaks of, or received authentic information concerning it, if he mean to describe it historically; for the latter, it is enough that he has seen several animals of that sort. The former tells us, what Achilles actually did and said; the latter, what such a species of human character as that which bears the name of Achilles would probably do or say in certain given circumstances.

It is indeed true, that the poet may, and often does, copy after individual objects. Homer, no doubt, took his characters from the life; or at least, in forming them, was careful to follow tradition as far as the nature of his plan would allow. But he probably took the freedom to add or heighten some qualities, and take away others; to make Achilles, for example, stronger, perhaps, and more impetuous, and more eminent for filial affection, and Hector more patriotic and more amiable than he really was. If he had not done this, or something like it, his work would have been rather a history than a poem; would have exhibited men and things as they were, and not as they might have been; and *Achilles* and *Hector* would have been the names of individual and real heroes; whereas, according to Aristotle, they are rather to be considered as two distinct modifications or species of the heroic character. Shakespeare's account of the cliffs of Dover comes so near the truth, that we cannot doubt of its having been written by one who had seen them: but he who takes it for an exact historical description, will be surprised when he comes to the place, and finds those cliffs not half so lofty as the poet had made him believe. An historian would be to blame for such amplification; because, being to describe an individual precipice, he ought to tell us just what it is; which if he did, the description would suit that place and perhaps no other in the whole world. But the poet means only to give an idea of what such a precipice may be: and therefore his description may perhaps be equally applicable to many such chalky precipices on the sea-shore.

This method of copying after general ideas formed by the artist from observation of many individuals, distinguishes the Italian and all the sublime painters, from the Dutch and their imitators. These give us bare nature, with the imperfections and peculiarities of individual things or persons; but those give nature improved as far as probability and the design of the piece will admit. Teniers and Hogarth draw faces, and figures, and dresses, from real life, and present manners; and therefore their pieces must in some degree lose the effect, and become awkward, when the present fashions become obsolete.——Raphael and Reynolds take their models from general nature; avoiding, as

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* Poetic. § 9.

22
in order to please all ages and countries.

far as possible, (at least in all their great performances), those peculiarities that derive their beauty from mere fashion; and therefore their works must give pleasure, and appear elegant as long as men are capable of forming general ideas, and of judging from them. The last-mentioned incomparable artist is particularly observant of children, whose looks and attitudes, being less under the controul of art and local manners, are more characteristical of the species than those of men and women. This field of observation has supplied him with many fine figures, particularly that most exquisite one of Comedy, struggling for and winning (for who could resist her!) the affections of Garrick:—a figure which could never have occurred to the imagination of a painter who had confined his views to grown persons looking and moving in all the formality of polite life;—a figure which in all ages and countries would be pronounced natural and engaging;—whereas those human forms that we see every day bowing and courtesying, and strutting, and turning out their toes *secundum artem*, and dressed in ruffles, and wigs, and flounces, and hoop-petticoats, and full-trimmed suits, would appear elegant no further than the present fashions are propagated, and no longer than they remain unaltered.

23
The period in the progress of human society to which epic and tragic poets should attend.

There is, in the progress of human society, as well as of human life, a period to which it is of great importance for the higher order of poets to attend, and from which they will do well to take their characters, and manners, and the era of their events; namely, that wherein men are raised above savage life, and considerably improved by arts, government, and conversation; but not advanced so high in the ascent towards politeness, as to have acquired a habit of disguising their thoughts and passions, and of reducing their behaviour to the uniformity of the mode. Such was the period which Homer had the good fortune (as a poet) to live in, and to celebrate. This is the period at which the manners of men are most picturesque, and their adventures most romantic. This is the period when the appetites unperverted by luxury, the powers unnervated by effeminacy, and the thoughts disengaged from artificial restraint, will, in persons of similar dispositions and circumstances, operate in nearly the same way; and when, consequently, the characters of particular men will approach to the nature of poetical or general ideas, and, if well imitated, give pleasure to the whole, or at least to a great majority of mankind. But a character tinctured with the fashions of polite life would not be so generally interesting. Like a human figure adjusted by a modern dancing-master, and dressed by a modern tailor, it may have a good effect in satire, comedy, or farce: but if introduced into the higher poetry, it would be admired by those only who had learned to admire nothing but present fashions, and by them no longer than the present fashions lasted; and to all the rest of the world would appear awkward, unaffecting, and perhaps ridiculous. But Achilles and Sarpedon, Diomede and Hector, Nestor and Ulysses, as drawn by Homer, must in all ages, independently on fashion, command the attention and admiration of mankind. These have the qualities that are universally known to belong to human nature; whereas the modern fine gentleman is distinguished by qualities that belong only to a particular age, society, and corner of the world. We speak not of moral or intellectual virtues, which are objects of admiration to every age; but of those outward accomplishments, and that particular temperature of the passions, which form the most perceptible part of a human character.——As, therefore, the politician, in discussing the rights of mankind, must often allude to an imaginary state of nature; so the poet who intends to raise admiration, pity, terror, and other important emotions, in the generality of mankind, especially in those readers whose minds are most improved, must take his pictures of life and manners, rather from the heroic period we now speak of, than from the ages of refinement; and must therefore (to repeat the maxim of Aristotle) "exhibit things, not as they are, but as they might be."

SECT. IV. *Of Poetical Characters.*

24
Requisites to the delineation of poetical characters.

HORACE seems to think, that a competent knowledge of moral philosophy will fit an author for assigning the suitable qualities and duties to each poetical personage: (*Art. Poet.* v. 309.—316.). The maxim may be true, as far as mere morality is the aim of the poet; but cannot be understood to refer to the delineation of poetical characters in general: for a thorough acquaintance with all the moral philosophy in the world would not have enabled Blackmore to paint such a personage as Homer's Achilles, Shakespeare's Othello, or the Satan of Paradise Lost. To a competency of moral science, there must be added an extensive knowledge of mankind, a warm and elevated imagination, and the greatest sensibility of heart, before a genius can be formed equal to so difficult a task. Horace is indeed so sensible of the danger of introducing a new character in poetry, that he even discourages the attempt, and advises the poet rather to take his persons from the ancient authors, or from tradition: *Ibid.* v. 119.—130.

25
Which, though elevated, should partake of the frailties of humanity;

To conceive the idea of a good man, and to invent and support a great poetical character, are two very different things, however they may seem to have been confounded by some late critics. The first is easy to any person sufficiently instructed in the duties of life: the last is perhaps of all the efforts of human genius the most difficult; so very difficult, that, though attempted by many, Homer, Shakespeare, and Milton, are almost the only authors who have succeeded in it. But characters of perfect virtue are not the most proper for poetry. It seems to be agreed, that the Deity should not be introduced in the machinery of a poetical fable. To ascribe to him words and actions of our own invention, seems very unbecoming; nor can a poetical description, that is known to be, and must of necessity be, infinitely inadequate, ever satisfy the human mind. Poetry, according to the best critics, is an imitation of human action; and therefore poetical characters, though elevated, should still partake of the passions and frailties of humanity. If it were not for the vices of some principal personages, the Iliad would not be either so interesting or so moral: the most moving and most eventful parts of the Æneid are those that describe the effects of unlawful passion:—the most instructive tragedy in the world, we mean Macbeth, is founded in crimes of dreadful enormity:—and if Milton had not taken into his plan the fall of our first parents, as well as their state of innocence, his divine poem must have wanted much of its pathos, and could not have been (what it now is) such a treasure of important knowledge, as no other uninspired writer ever comprehended in so small a compass.—— Virtue, like truth, is uniform and unchangeable. We may anticipate the part a good man will act in any given circumstances: and therefore the events that depend on such a man must be less surprising than those which proceed from passion; the vicissitudes whereof it is frequently impossible to foresee. From the violent temper of Achilles, in the Iliad, spring many great incidents; which could not have taken place, if he had been calm and prudent like Ulysses, or pious and patriotic like Eneas: his rejection of Agamemnon's offers, in the ninth book, arises from the violence of his resentment;—his yielding to the request of Patroclus, in the 16th, from the violence of his friendship (if we may so speak) counteracting his resentment; and his restoring to Priam the dead body of Hector, in the 24th, from the violence of his affection to his own aged father, and his regard to the command of Jupiter, counteracting, in some measure, both his sorrow for his friend, and his thirst for vengeance.——Besides, except where there is some degree of vice, it pains us too exquisitely to see misfortune; and therefore poetry would cease to have a pleasurable influence over our tender passions, if it were to exhibit virtuous characters only. And as in life, evil is necessary to our moral probation, and the possibility of error to our intellectual improvement; so bad or mixed characters are useful in poetry, to give to the good such opposition, as puts them upon displaying and exercising their virtue.

26
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All these personages, however, in whose fortune the poet means that we should be interested, must have agreeable and admirable qualities to recommend them to our regard. And perhaps the greatest difficulty in the art lies in suitably blending those faults which the poet finds it expedient to give to any particular hero, with such moral, intellectual, or corporeal accomplishments, as may engage our esteem, pity, or admiration, without weakening our hatred of vice, or love of virtue. In most of our novels, and in many of our plays, it happens unluckily, that the hero of the piece is so captivating, as to incline us to be indulgent to every part of his character, the bad as well as the good. But a great master knows how to give the proper direction to human sensibility; and, without any perversion of our faculties, or any confusion of right and wrong, to make the same person the object of very different emotions, of pity and hatred, of admiration and horror. Who does not esteem and admire Macbeth for his courage and generosity? who does not pity him when beset with all the terrors of a pregnant imagination, superstitious temper, and awakened conscience? who does not abhor him as a monster of cruelty, treachery, and ingratitude? His good qualities, by drawing us near to him, make us, as it were, eye-witnesses of his crime, and give us a fellow-feeling of his remorse; and therefore, his example cannot fail to have a powerful effect in cherishing our love of virtue, and fortifying our minds against criminal impressions; whereas, had he wanted those good qualities, we should have kept aloof from his concerns, or viewed them with a superficial attention; in which case his example would have had little more weight than that of the robber, of whom we know nothing, but that he was tried, condemned, and executed.—Satan, in Paradise Lost, is a character drawn and supported with the most consummate judgment. The old furies and demons, Hecate, Tisiphone, Alecto, Megara, are objects of unmixed and unmitigated abhorrence; Tityus, Enceladus, and their brethren, are remarkable for nothing but impiety, deformity, and vastness of size; Pluto is, at best, an insipid personage; Mars, a hair-brained ruffian; Tasso's infernal tyrant, an ugly and overgrown monster:—but in the Miltonic Satan, we are forced to admire the majesty of the ruined archangel, at the same time that we detest the unconquerable depravity of the fiend. "But, of all poetical characters, (says the elegant critic from whom we are extracting), the Achilles of Homer (D) seems to me the most exquisite of invention, and the most highly finished. The utility of this character in a moral view is obvious; for it may be considered as the source of all the morality of the Iliad. Had not the generous and violent temper of Achilles determined him to patronize the augur Calchas in defiance of Agamemnon, and afterwards on being affronted by that vindictive commander, to abandon for a time the common cause of Greece;—the fatal effects of dissension among confederates, and of capricious and tyrannical behaviour in a sovereign, would not have been the leading moral of Homer's poetry; nor could Hector, Sarpedon, Eneas, Ulysses, and the other amiable heroes, have been brought forward to signalize their virtues, and to recommend themselves to the esteem and imitation of mankind.

Beattie's Essays.

27
The excellence of the poetical character of Achilles, and

"They who form their judgment of Achilles from the imperfect sketch given of him by Horace in the *Art of Poetry*, (v. 121, 122.); and consider him only as a hateful composition of anger, revenge, fierceness, obstinacy and pride, can never enter into the views of Homer, nor be suitably affected with his narration. All these vices are no doubt, in some degree, combined in Achilles; but they are tempered with qualities of a different sort, which render him a most interesting character, and of course make the Iliad a most interesting poem. Every reader abhors the faults of this hero: and yet, to an attentive reader of Homer, this hero must be the object of esteem, admiration, and pity; for he has many good as well as bad affections, and is equally violent

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(D) "I say the *Achilles of Homer*. Later authors have degraded the character of this hero, by supposing every part of his body invulnerable except the heel. I know not how often I have heard this urged as one of Homer's absurdities; and indeed the whole Iliad is one continued absurdity, on this supposition. But Homer all along makes his hero equally liable to wounds and death with other men. Nay, to prevent all mistakes in regard to this matter, (if those who cavil at the poet would but read his work), he actually wounds him in the right arm by the lance of Asteropæus, in the battle near the river Scamander." See *Iliad* xxi. verse 161—168.

violent in all:—Nor is he possessed of a single vice or virtue, which the wonderful art of the poet has not made subservient to the design of the poem, and to the progress and catastrophe of the action; so that the hero of the Iliad, considered as a poetical personage, is just what he should be, neither greater nor less, neither worse nor better.—He is everywhere distinguished by an abhorrence of oppression, by a liberal and elevated mind, by a passion for glory, and by a love of truth, freedom, and sincerity. He is for the most part attentive to the duties of religion; and, except to those who have injured him, courteous and kind: he is affectionate to his tutor Phenix; and not only pities the misfortunes of his enemy Priam, but in the most soothing manner administers to him the best consolation that Homer's poor theology could furnish. Though no admirer of the cause in which his evil destiny compels him to engage, he is warmly attached to his native land; and, ardent as he is in vengeance, he is equally so in love to his aged father Peleus, and to his friend Patroclus. He is not luxurious like Paris, or clownish like Ajax; his accomplishments are princely, and his amusements worthy of a hero. Add to this, as an apology for the vehemence of his anger, that the affront he had received was (according to the manners of that age) of the most atrocious nature; and not only unprovoked, but such as, on the part of Agamemnon, betrayed a brutal insensibility to merit, as well as a proud, selfish, ungrateful, and tyrannical disposition. And though he is often inexcusably furious; yet it is but justice to remark, that he was not naturally cruel (E); and that his wildest outrages were such as in those rude times might be expected from a violent man of invincible strength and valour, when exasperated by injury, and frantic with sorrow. Our hero's claim to the admiration of mankind is indisputable. Every part of his character is sublime and astonishing. In his person, he is the strongest, the swiftest, the most beautiful of men:—this last circumstance, however, occurs not to his own observation, being too trivial to attract the notice of so great a mind. The Fates had put it in his power, either to return home before the end of the war, or to remain at Troy:—if he chose the former, he would enjoy tranquillity and happiness in his own country to a good old age; if the latter, he must perish in the bloom of his youth:—his affection to his father and native country, and his hatred to Agamemnon, strongly urged him to the first; but a desire to avenge the death of his friend determines him to accept the last with all its consequences. This at once displays the greatness of his fortitude, the warmth of his friendship, and the violence of his sanguinary passions: and it is this that so often and so powerfully recommends him to the pity, as well as admiration, of the attentive reader."

28
Of all Homer's characters.

It is equally a proof of rich invention and exact judgment in Homer, that he mixes some good qualities in all his bad characters, and some degree of imperfection in almost all his good ones.—Agamemnon, notwithstanding his pride, is an able general, and a valiant man, and highly esteemed as such by the greater part of the army.—Paris, though effeminate, and vain of his dress and person, is, however, good-natured, patient of reproof, not destitute of courage, and eminently skilled in music and other fine arts.—Ajax is a huge giant; fearless rather from insensibility to danger, and confidence in his massy arms, than from any nobler principle; boastful and rough; regardless of the gods, though not downright impious: yet there is in his manner something of frankness and blunt sincerity, which entitle him to a share in our esteem; and he is ever ready to assist his countrymen, to whom he renders good service on many a perilous emergency.——The character of Helen, in spite of her faults, and of the many calamities whereof she is the guilty cause, Homer has found means to recommend to our pity, and almost to our love; and this he does, without seeking to extenuate the crime of Paris, of which the most respectable personages in the poem are made to speak with becoming abhorrence. She is so full of remorse, so ready on every occasion to condemn her past conduct, so affectionate to her friends, so willing to do justice to every body's merit, and withal so finely accomplished, that she extorts our admiration, as well as that of the Trojan senators.——Menelaus, though sufficiently sensible of the injury he had received, is yet a man of moderation, clemency, and good-nature, a valiant soldier, and a most affectionate brother: but there is a dash of vanity in his composition, and he entertains rather too high an opinion of his own abilities, yet never overlooks nor undervalues the merit of others.—Priam would claim unreserved esteem, as well as pity, if it were not for his inexcuseable weakness, in gratifying the humour, and by indulgence abetting the crimes, of the most worthless of all his children, to the utter ruin of his people, family, and kingdom. Madame Dacier supposes, that he had lost his authority, and was obliged to fall in with the politics of the times: but of this there appears no evidence; on the contrary, he and his unworthy favourite Paris seem to have been the only persons of distinction in Troy who were averse to the restoring of Helen. Priam's foible (if it can be called by so soft a name), however faulty, is not uncommon, and has often produced calamity both in private and public life. The Scripture gives a memorable instance in the history of the good old Eli.——Sarpedon comes nearer a perfect character than any other of Homer's heroes; but the part he has to act is short. It is a character which one could hardly have expected in those rude times: a sovereign prince, who considers himself as a magistrate set up by the people for the public good, and therefore bound in honour and gratitude to be himself their example, and study to excel as much in virtue as in rank and authority.——Hector is the favourite of every reader, and with good reason. To the truest valour he joins the most generous patriotism. He abominates the crime of Paris: but not being able to prevent the war, he thinks it his duty to defend his country, and his father and sovereign, to the last. He too, as well as Achilles, foresees his

Beattie, ut supra.

(E) See *Iliad* xxi. 100. and xxiv. 485—673.—In the first of these passages, Achilles himself declares, that before Patroclus was slain, he often spared the lives of his enemies, and took pleasure in doing it. It is strange, as Dr Beattie observes, that this should be left out in Pope's Translation.

his own death; which heightens our compassion, and raises our idea of his magnanimity. In all the relations of private life, as a son, a father, a husband, a brother, he is amiable in the highest degree; and he is distinguished among all the heroes for tenderness of affection, gentleness of manners, and a pious regard to the duties of religion. One circumstance of his character, strongly expressive of a great and delicate mind, we learn from Helen's lamentation over his dead body, that he was almost the only person in Troy who had always treated her with kindness, and never uttered one reproachful word to give her pain, nor heard others reproach her without blaming them for it. Some tendency to ostentation (which however may be pardonable in a commander in chief), and temporary fits of timidity, are the only blemishes discoverable in this hero; whose portrait Homer appears to have drawn with an affectionate and peculiar attention.

By ascribing so many amiable qualities to Hector and some others of the Trojans, the poet interests us in the fate of that people, notwithstanding our being continually kept in mind that they are the injurious party. And by thus blending good and evil, virtue and frailty, in the composition of his characters, he makes them the more conformable to the real appearances of human nature, and more useful as examples for our improvement; and at the same time, without hurting verisimilitude, gives every necessary embellishment to particular parts of his poem, and variety, coherence, and animation, to the whole fable. And it may also be observed, that though several of his characters are complex, not one of them is made up of incompatible parts: all are natural and probable, and such as we think we have met with, or might have met with, in our intercourse with mankind.

29
Virgil fails in drawing characters.

From the same extensive views of good and evil in all their forms and combinations, Homer has been enabled to make each of his characters perfectly distinct in itself, and different from all the rest; insomuch that before we come to the end of the Iliad, we are as well acquainted with his heroes, as with the faces and tempers of our most familiar friends. Virgil, by confining himself to a few general ideas of fidelity and fortitude, has made his subordinate heroes a very good sort of people; but they are all the same, and we have no clear knowledge of any one of them. Achates is faithful, and Gyas is brave, and Cloanthus is brave: and this is all we can say of the matter. We see these heroes at a distance, and have some notion of their shape and size; but are not near enough to distinguish their features; and every face seems to exhibit the same faint and ambiguous appearance. But of Homer's heroes we know every particular that can be known. We eat, and drink, and talk, and fight, with them: we see them in action and out of it; in the field and in their tents and houses: the very face of the country about Troy we seem to be as well acquainted with as if we had been there. Similar characters there are among these heroes, as there are similar faces in every society; but we never mistake one for another. Nestor and Ulysses are both wise and both eloquent: but the wisdom of the former seems to be the effect of experience; that of the latter of genius: the eloquence of the one is sweet and copious, but not always to the purpose, and apt to degenerate into story-telling; that of the other is close, emphatical, and persuasive, and accompanied with a peculiar modesty and simplicity of manner. Homer's heroes are all valiant; yet each displays a modification of valour peculiar to himself; one is valiant from principle, another from constitution; one is rash, another cautious; one is impetuous and headstrong, another impetuous, but tractable; one is cruel, another merciful; one is insolent and ostentatious, another gentle and unassuming; one is vain of his person, another of his strength, and a third of his family.—It would be tedious to give a complete enumeration. Almost every species of the heroic character is to be found in Homer.

30
The difficulty of drawing and discriminating the characters in Paradise Lost.

Of the agents in Paradise Lost, it has been observed*, that "the weakest are the highest and noblest of human beings, the original parents of mankind; with whose actions the elements consented; on whose rectitude or deviation of will depended the state of terrestrial nature, and the condition of all the future inhabitants of the globe. Of the other agents in the poem, the chief are such as it is irreverence to name on slight occasions: the rest are lower powers;

> ——Of which the least could wield
> These elements, and arm him with the force
> Of all their regions:

Powers, which only the controul of Omnipotence restrains from laying creation waste, and filling the vast expanse of space with ruin and confusion. To display the motives and actions of beings thus superior, so far as human reason can examine, or human imagination represent them, is the task which Milton undertook and performed. The characters in the Paradise Lost, which admit of examination, are those of angels and of men: of angels good and evil; of man in his innocent and sinful state.

"Among the angels, the virtue of Raphael is mild and placid, of easy condescension, and free communication: that of Michael is regal and lofty, attentive to the dignity of his own nature. Abdiel and Gabriel appear occasionally, and act as every incident requires: the solitary fidelity of Abdiel is very amiably painted.

31
Milton's success in this part of his undertaking.

"Of the evil angels, the characters are more diversified. To Satan such sentiments are given as suit the most exalted and most depraved being. Milton has been censured for the impiety which sometimes breaks from Satan's mouth; for there are thoughts, it is justly remarked, which no observation of character can justify; because no good man would willingly permit them to pass, however transiently, through his mind. This censure has been shown to be groundless by the great critic from whom we quote. To make Satan speak as a rebel, says he, without any such expressions as might taint the reader's imagination, was indeed one of the great difficulties in Milton's undertaking; and I cannot but think that he has extricated himself with great happiness. There is in Satan's speeches little that can give pain to a pious ear. The language of rebellion cannot be the same with that of obedience: the malignity of Satan foams in haughtiness and obstinacy; but his expressions are commonly general, and no otherwise offensive than as they are wicked.—The other chiefs of the celestial rebellion are very judiciously discriminated; and the ferocious character of Moloch appears, both in the battle and in the council, with exact consistency.

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* *Johnson's Life of Milton.*

"To Adam and to Eve are given, during their innocence, such sentiments as innocence can generate and utter. Their love is pure benevolence and mutual veneration; their repasts are without luxury, and their diligence without toil. Their addresses to their Maker have little more than the voice of admiration and gratitude: fruition left them nothing to ask, and innocence left them nothing to fear. But with guilt enter distrust and discord, mutual accusation and stubborn self-defence: they regard each other with alienated minds, and dread their Creator as the avenger of their transgression; at last, they seek shelter in his mercy, soften to repentance, and melt in supplication. Both before and after the fall, the different sentiments arising from difference of sex are traced out with inimitable delicacy and philosophical propriety. Adam has always that pre-eminence in dignity, and Eve in loveliness, which we should naturally look for in the father and mother of mankind.

32
Poetry according to nature improved to that degree which is consistent with probability.

From what has been said, it seems abundantly evident,—That the end of poetry is to please; and therefore that the most perfect poetry must be the most pleasing;—that what is unnatural cannot give pleasure; and therefore that poetry must be according to nature:—that it must be either according to real nature, or according to nature somewhat different from the reality;—that, if according to real nature, it would give no greater pleasure than history, which is a transcript of real nature;—that greater pleasure is, however, to be expected from it, because we grant it superior indulgence, in regard to fiction, and the choice of words;—and, consequently, that poetry must be, not according to real nature, but according to nature improved to that degree which is consistent with probability and suitable to the poet's purpose.——And hence it is that we call poetry, *An imitation of nature.*—For that which is properly termed *imitation* has always in it something which is not in the original. If the prototype and transcript be exactly alike; if there be nothing in the one which is not in the other; we may call the latter a *representation*, a *copy*, a *draught*, or a *picture*, of the former; but we never call it an *imitation.*

SECT. V. *Of Arrangement, Unity, Digression.—Further remarks on Nature in Poetry.*

33
How a poem ought to begin.

I. THE origin of nations, and the beginnings of great events, are little known, and seldom interesting; whence the first part of every history, compared with the sequel, is somewhat dry and tedious. But a poet must, even in the beginning of his work, interest the readers, and raise high expectation; not by an affected pomp of style, far less by ample promises or bold professions; but by setting immediately before them some incident, striking enough to raise curiosity, in regard both to its causes and to its consequences. He must therefore take up his story, not at the beginning, but in the middle; or rather, to prevent the work from being too long, as near the end as possible; and afterwards take some proper opportunity to inform us of the preceding events, in the way of narrative, or by conversation of the persons introduced, or by short and natural digressions.

The action of both the *Iliad* and *Odyssey* begins about six weeks before its conclusion; although the principal events of the war of Troy are to be found in the former; and the adventures of a ten years voyage, followed by the suppression of a dangerous domestic enemy, in the latter. One of the first things mentioned by Homer in the Iliad, is a plague, which Apollo in anger sent into the Grecian army commanded by Agamemnon and now encamped before Troy. Who this Agamemnon was, and who the Grecians were; for what reason they had come hither; how long the siege had lasted; what memorable actions had been already performed; and in what condition both parties now were:—all this, and much more, we soon learn from occasional hints and conversations interspersed through the poem.

In the *Æneid*, which, though it comprehends the transactions of seven years, opens within a few months of the concluding event, we are first presented with a view of the Trojan fleet at sea, and no less a person than Juno interesting herself to raise a storm for their destruction. This excites a curiosity to know something further: who these Trojans were, whence they had come, and whither they were bound; why they had left their own country, and what had befallen them since they left it. On all these points, the poet, without quitting the track of his narrative, soon gives the fullest information: The storm rises; the Trojans are driven to Africa, and hospitably received by the queen of the country; at whose desire their commander relates his adventures.

The action of *Paradise Lost* commences not many days before Adam and Eve are expelled from the garden of Eden, which is the concluding event. This poem, as its plan is incomparably more sublime and more important than that of either the Iliad or Æneid, opens with a far more interesting scene: a multitude of angels and archangels shut up in a region of torment and darkness, and rolling on a lake of unquenchable fire. Who these angels are, and what brought them into this miserable condition, we naturally wish to know; and the poet in due time informs us; partly from the conversation of the fiends themselves; and more particularly by the mouth of a happy spirit, sent from heaven to caution the father and mother of mankind against temptation, and confirm their good resolutions by unfolding the dreadful effects of impiety and disobedience.

Beattie, ut supra.

34
The advantage of the poetical arrangement.

This poetical arrangement of events, so different from the historical, has other advantages besides those arising from brevity and compactness of detail: it is obviously more affecting to the fancy, and more alarming to the passions; and, being more suitable to the order and the manner in which the actions of other men strike our senses, is a more exact imitation of human affairs. I hear a sudden noise in the street, and run to see what is the matter. An insurrection has happened, a great multitude is brought together, and something very important is going forward. The scene before me is the first thing that engages my attention; and is in itself so interesting, that for a moment or two I look at it in silence and wonder. By and by, when I get time for reflection, I begin to inquire into the cause of all this tumult, and what it is the people would be at; and one who is better informed than I, explains the affair from the beginning; or perhaps I make this out for myself, from the words and actions of the persons principally concerned. This is a sort of picture of poetical arrangement, both in epic and dramatic composition; and this plan has been followed in narrative odes and ballads both ancient and modern.—The historian pursues a different method. He begins perhaps with an account of the manners of a certain age, and of the political constitution of a certain country; then introduces a particular person, gives the story of his birth, connections, private character, pursuits, disappointments, and of the events that promoted his views, and brought him acquainted with other turbulent spirits like himself; and so proceeds, unfolding, according to the order of time, the causes, principles, and progress of the conspiracy, if that be the subject which he undertakes to illustrate. It cannot be denied, that this latter method is more favourable to calm information: but the former, compared with it, will be found to have all the advantages already specified, and to be more effectually productive of that mental pleasure which depends on the passions and imagination.

35
Unity of design necessary to the higher poetry.

II. If a work have no determinate end, it has no meaning; and if it have many ends, it will distract by it multiplicity. Unity of design, therefore, belongs in some measure, to all compositions, whether in verse or prose. But to some it is more essential than to others; and to none so much as in the higher poetry. In certain kinds of history, there is unity sufficient if all the events recorded be referred to one person; in others, if to one period of time, or to one people, or even to the inhabitants of one and the same planet. But it is not enough that the subject of a poetical fable be the exploits of one person; for these may be of various and even of opposite sorts and tendencies, and take up longer time than the nature of poetry can admit:—far less can a regular poem comprehend the affairs of one period or of one people:—it must be limited to one great action or event, to the illustration of which all the subordinate events must contribute; and these must be so connected with one another, as well as with the poet's general purpose, that one cannot be changed, transposed, or taken away, without affecting the consistence and stability of the whole *. In itself an incident may be interesting, a character well drawn, a description beautiful; and yet, if it disfigure the general plan, or if it obstruct or encumber the main action, instead of helping it forward, a correct artist would consider it but as a gaudy superfluity or splendid deformity; like a piece of scarlet cloth sewed upon a garment of a different colour †. Not that all the parts of the fable either are, or can be, equally essential. Many descriptions and thoughts, of little consequence to the plan, may be admitted for the sake of variety: and the poet may, as well as the historian and philosopher, drop his subject for a time, in order to take up an affecting or instructive digression.

36
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III. The doctrine of poetical digressions and episodes has been largely treated by the critics. We shall here only remark, that, in estimating their propriety, three things are to be attended to:—their connection with the fable or subject; their own peculiar excellence; and their subserviency to the poet's design.

37
eir connection
ith the
bject of
e poem.

(1.) Those digressions that both arise from and terminate in the subject, like the episode of the angel Raphael in Paradise Lost, and the transition to the death of Cæsar and the civil wars in the first book of the Georgic, are the most artful, and if suitably executed, claim the highest praise:—those that arise from, but do not terminate in, the subject, are perhaps second in the order of merit; like the story of Dido in the Æneid, and the encomium on a country life in the second book of the Georgic: those come next that terminate in, but do not rise from, the fable; of which there are several in the third book of the Æneid and in the Odyssey:—and those that neither terminate in the fable nor rise from it are the least artful; and if they be long, cannot escape censure, unless their beauty be very great.

38
Their own peculiar excellence, and

But (2.) we are willing to excuse a beautiful episode at whatever expence to the subject it may be introduced. They who can blame Virgil for obtruding upon them the charming tale of Orpheus and Euridice in the fourth Georgic, or Milton for the apostrophe to light in the beginning of this third book, ought to forfeit all title to the perusal of good poetry; for of such divine strains one would rather be the author than of all the books of criticism in the world. Yet still it is better that an episode possess the beauty of connection, together with its own intrinsic elegance, than this without the other.

39
their subserviency to the poet's design.

Moreover, in judging of the propriety of episodes and other similar contrivances, it may be expedient to attend (3.) to the design of the poet, as distinguished from the fable or subject of the poem. The great design, for example, of Virgil, was to interest his countrymen in a poem written with a view to reconcile them to the person and government of Augustus. Whatever, therefore, in the poem tends to promote this design, even though it should in some degree hurt the contexture of the fable, is really a proof of the poet's judgment; and may be not only allowed, but applauded.—The progress of the action of the Æneid may seem to be too long obstructed in one place by the story of Dido, which, though it rises from the preceding part of the poem, has no influence upon the sequel: and, in another, by the episode of Cacus, which, without injury to the fable, might have been omitted altogether. Yet these episodes, interesting as they are to us and all mankind because of the transcendant merit of the poetry, must have been still more interesting to the Romans because of their connection with the Roman affairs; for the one accounts poetically for their wars with Carthage; and the other not only explains some of their religious ceremonies, but also gives a most charming rural picture of those hills and valleys in the neighbourhood of the Tiber, on which, in after times, their majestic city was fated to stand.—And if we consider, that the design of Homer's Iliad was not only to show the fatal effects of dissension among confederates, but also to immortalize his country, and celebrate the most distinguished families in it, we shall be inclined to think more favourably than critics generally do of some of his long speeches and digressions; which, though to us they may seem trivial, must have been very interesting to his countrymen on account of the genealogies and private history recorded in them.—Shakespeare's historical plays, considered as dramatic fables, and tried by the laws of tragedy and comedy, appear very rude compositions; but if we attend to the poet's design (as the elegant critic ‡ has with equal truth and beauty explained it), we shall be forced to admire his judgment in the general conduct of those pieces, as well as unequalled success in the execution of particular parts.

There is yet another point of view in which these digressions may be considered. If they tend to elucidate any important character, or to introduce any interesting event not otherwise within the compass of the poem, or to

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* *Arist. Poet.* § 8.

† *Hor. Ar. Poet.* v. 15. &c.

‡ *Essays on the writings and genius of Shakespeare*, p. 55.

to give an amiable display of any particular virtue, they may be intitled, not to our pardon only, but even to our admiration, however loosely they may hang upon the fable. All these three ends are effected by that most beautiful episode of Hector and Andromache in the sixth book of the Iliad; and the two last, by the no less beautiful one of Euryalus and Nisus in the ninth book of the Æneid.

IV. And now, from the position formerly established, that the end of this divine art is to give pleasure, it has been endeavoured to prove, that, whether in displaying the appearances of the material universe, or in imitating the workings of the human mind, and the varieties of human character, or in arranging and combining into one whole the several incidents and parts whereof his fable consists,—the aim of the poet must be to copy nature, not as it is, but in that state of perfection in which, consistently with the particular genius of the work, and the laws of verisimilitude, it may be supposed to be.

40
Nature always to be improved by the poet, though

Such, in general, is the nature of that poetry which is intended to raise admiration, pity, and other serious emotions. But in this art, as in all others, there are different degrees of excellence; and we have hitherto directed our view chiefly to the highest. All serious poets are not equally solicitous to improve nature. Euripides is said to have represented men as they were; Sophocles, more poetically, as they should or might be *. Theocritus in his Idyls, and Spenser in his Shepherd's Calendar, give us language and sentiments more nearly approaching those of the *Rus verum et barbarum* †, than what we meet with in the Pastorals of Virgil and Pope. In the historical drama, human characters and events must be according to historical truth, or at least not so remote from it as to lead into any important misapprehension of fact. And in the historical epic poem, such as the Pharsalia of Lucan, and the Campaign of Addison, the historical arrangement is preferred to the poetical, as being nearer the truth. Yet nature is a little improved even in these poems. The persons in Shakespeare's historical plays, and the heroes of the Pharsalia, talk in verse, and suitably to their characters, and with a readiness, beauty, and harmony of expression, not to be met with in real life, nor even in history: speeches are invented, and, to heighten the description, circumstances added, with great latitude: real events are rendered more compact and more strictly dependent upon one another; and fictitious ones brought in, to elucidate human characters and diversify the narration.

The more poetry improves nature, by copying after general ideas collected from extensive observation, the more it partakes (according to Aristotle) of the nature of philosophy; the greater stretch of fancy and of observation it requires in the artist, the better chance it has to be universally agreeable.

41
when poetry falls short of this perfection it may have great merit in other respects.

Yet poetry, when it falls short of this perfection, may have great merit as an instrument of both instruction and pleasure. To most men, simple unadorned nature is, at certain times, and in certain compositions, more agreeable than the most elaborate improvements of art; as a plain short period, without modulation, gives a pleasing variety to a discourse. Many such portraits of simple nature there are in the subordinate parts both of Homer's and of Virgil's poetry: and an excellent effect they have in giving probability to the fiction, as well as in gratifying the reader's fancy with images distinct and lively, and easily comprehended. The historical plays of Shakespeare raise not our pity and terror to such a height as Lear, Macbeth, or Othello; but they interest and instruct us greatly notwithstanding. The rudest of the eclogues of Theocritus, or even of Spenser, have by some authors been extolled above those of Virgil, because more like real life. Nay, Corneille is known to have preferred the Pharsalia to the Æneid, perhaps from its being nearer the truth, or perhaps from the sublime sentiments of stoical morality so forcibly and so ostentatiously displayed in it.

Poets may refine upon nature too much as well as too little; for affectation and rusticity are equally remote from true elegance. The style and sentiments of comedy should no doubt be more correct and more pointed than those of the most polite conversation: but to make every footman a wit, and every gentleman and lady an epigrammatist, as Congreve has done, is an excessive and faulty refinement. The proper medium has been hit by Menander and Terence, by Shakespeare in his happier scenes, and by Garrick, Cumberland, and some others of late renown. To describe the passion of love with as little delicacy as some men speak of it would be unpardonable; but to transform it into mere Platonic adoration is to run into another extreme, less criminal indeed, but too remote from universal truth to be universally interesting. To the former extreme Ovid inclines, and Petrarch and his imitators to the latter. Virgil has happily avoided both: but Milton has painted this passion as distinct from all others, with such peculiar truth and beauty, that we cannot think Voltaire's encomium too high, when he says, that love in all other poetry seems a weakness, but in Paradise Lost a virtue. There are many good strokes of nature in Ramsay's Gentle Shepherd; but the author's passion for the *rus verum* betrays him into some indelicacies: a censure that falls with greater weight upon Theocritus, who is often absolutely indecent. The Italian pastoral of Tasso and Guarini, and the French of Fontenelle, run into the opposite extreme (though in some parts beautifully simple), and display a system of rural manners so quaint and affected as to outrage all probability. In fine, though mediocrity of execution in poetry be allowed to deserve the doom pronounced upon it by Horace; yet it is true, notwithstanding, that in this art, as in many other good things, the point of excellence lies in a middle between two extremes; and has been reached by those only who sought to improve nature as far as the genius of their work would permit, keeping at an equal distance from rusticity on the one hand and affected elegance on the other.

Sect. VI. *Of Poetical Language.*

42
Words in poetry to be chosen for their sense and for their sound.

Words in poetry are chosen, first, for their *sense*; and, secondly, for their *sound*. That the first of these grounds of choice is the more excellent nobody can deny. He who in literary matters prefers sound to sense is a fool. Yet sound is to be attended to even in prose, and in verse demands particular attention. We shall consider poetical language, first, as SIGNIFICANT; and, secondly, as SUSCEPTIBLE OF HARMONY.

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* Arist. Poet.

† Martial.

§ 1. *Of Poetical Language considered as* SIGNIFICANT.

43 The language of poetry an imitation of the language of nature.

If, as it has been endeavoured to prove, poetry be imitative of nature, poetical fictions of real events, poetical images of real appearances in the visible creation, and poetical personages of real human characters; it would seem to follow, that the *language of poetry* must be an imitation of the *language of nature*.

According to Dr Beattie [*], that language is natural which is suited to the speaker's condition, character, and circumstances. And as, for the most part, the images and sentiments of serious poetry are copied from the images and sentiments, not of real, but of improved, nature; so the language of serious poetry must (as hinted already) be a transcript, not of the real language of nature, which is often dissonant and rude, but of natural language improved as far as may be consistent with probability, and with the supposed character of the speaker. If this be not the case, if the language of poetry be such only as we hear in conversation or read in history, it will, instead of delight, bring disappointment: because it will fall short of what we expect from an art which is recommended rather by its pleasurable qualities than by its intrinsic utility; and to which, in order to render it pleasing, we grant higher privileges than to any other kind of literary composition, or any other mode of human language.

44 Improved as far as may be consistent with probability, &c.

The next inquiry must therefore be, "What are those improvements that peculiarly belong to the language of poetry?" And these may be comprehended under two heads; *poetical words*, and *tropes and figures*.

Art. I. Of Poetical Words.

45 All languages have words peculiar to poetry.

One mode of improvement peculiar to poetical diction results from the use of those words and phrases which, because they rarely occur in prose, and frequently in verse, are by the grammarian and lexicographer termed *poetical*. In these some languages abound more than others: but no language perhaps is altogether without them, and perhaps no language can be so in which any number of good poems have been written: for poetry is better remembered than prose, especially by poetical authors, who will always be apt to imitate the phraseology of those they have been accustomed to read and admire; and thus, in the works of poets down through successive generations, certain phrases may have been conveyed, which, though originally perhaps in common use, are now confined to poetical composition. Prose writers are not so apt to imitate one another, at least in words and phrases, both because they do not so well remember one another's phraseology, and also because their language is less artificial, and must not, if they would make it easy and flowing (without which it cannot be elegant), depart essentially from the style of correct conversation. Poets, too, on account of the greater difficulty of their numbers, have, both in the choice and in the arrangement of words, a better claim to indulgence, and stand more in need of a discretionary power.

The language of Homer differs materially from what was written and spoken in Greece in the days of Socrates. It differs in the mode of inflection, it differs in the syntax, it differs even in the words: so that one might read Homer with ease who could not read Xenophon; or Xenophon, without being able to read Homer. Yet we cannot believe that Homer, or the first Greek poet who wrote in his style, would make choice of a dialect quite different from what was intelligible in his own time: for poets have in all ages written with a view to be read, and to be read with pleasure; which they could not be if their diction were hard to be understood. It is more reasonable to suppose that the language of Homer is according to some ancient dialect, which, though not perhaps in familiar use among the Greeks at the time he wrote, was however intelligible. From the Homeric to the Socratic age, a period had elapsed of no less than 400 years; during which the style both of discourse and of writing must have undergone great alterations. Yet the Iliad continued the standard of heroic poetry, and was considered as the very perfection of poetical language; notwithstanding that some words in it were become so antiquated, or so ambiguous, that Aristotle himself seems to have been somewhat doubtful in regard to their meaning[†]. And if Chaucer's merit as a poet had been as great as Homer's, and the English tongue under Edward III. as perfect as the Greek was in the second century after the Trojan war, the style of Chaucer would probably have been our model for poetical diction at this day; even as Petrarch, his contemporary, is still imitated by the best poets of Italy.

46 The poetical dialect different from that of prose.

The rudeness of the style of Ennius has been imputed by the old critics to his having copied too closely the dialect of common life. But this appears to be a mistake. For if we compare the fragments of that author with the comedies of Plautus, who flourished in the same age, and whose language was certainly copied from that of common life, we shall be struck with an air of antiquity in the former that is not in the latter. Ennius, no doubt, like most other sublime poets, affected something of the antique in his expression: and many of his words and phrases, not adopted by any prose writer now extant, are to be found in Lucretius and Virgil, and were by them transmitted to succeeding poets. These form part of the Roman poetical dialect; which appears from the writings of Virgil, where we have it in perfection, to have been very copious. The style of this charming poet is indeed so different from prose, and is altogether so peculiar, that it is perhaps impossible to analyse it on the common principles of Latin grammar. And yet no author can be more perspicuous or more expressive; notwithstanding the frequency of Grecism in his syntax, and his love of old words, which he, in the judgment of Quintilian, knew better than any other man how to improve into decoration[||].

The poetical dialect of modern Italy is so different from the prosaic, that persons who can read the historians, and even speak with tolerable fluency the language of that country, may yet find it difficult to construe a page of Petrarch or Tasso. Yet it is not probable, that Petrarch, whose works are a standard of the Italian poetical diction[§], made any material innovations in his native tongue. It is rather probable that he wrote it nearly as it was spoken in his time, that is, in the 14th century; omitting only harsh combinations, and taking that liberty which Homer probably, and Virgil certainly, took before him, of reviving such old but not obsolete expressions, as seemed peculiarly significant and melodious; and polishing his style to that degree of elegance which human speech, without becoming unnatural, may admit of, and which the genius of poetry, as an art subservient to pleasure, may be thought to require.

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[*] *Essays*, Part ii. chap. 1.

[†] *Poetic.* cap. 25.

[||] *Instit.* viii. 3. § 3.

[§] *Vicende della litteratura del Denina*, cap. 4.

The French poetry in general is distinguished from prose rather by the rhime and the measure, than by any old or uncommon phraseology. Yet the French, on certain subjects, imitate the style of their old poets, of Marot in particular; and may therefore be said to have something of a poetical dialect, though far less extensive than the Italian, or even than the English. And it may be presumed, that in future ages they will have more of this dialect than they have at present. This may be inferred from the very uncommon merit of some of their late poets, particularly Boileau and La Fontaine, who, in their respective departments, will continue to be imitated, when the present modes of French prose are greatly changed: an event that, for all the pains they take to preserve their language, must inevitably happen, and whereof there are not wanting some presages already.

The English poetical dialect is not characterised by any peculiarities of inflection, nor by any great latitude in the use of foreign idioms. More copious it is, however, than one would at first imagine; as may appear from the following specimen and observations.

47
Phrases in English poetry not usual in prose.

(1.) A few Greek and Latin idioms are common in English poetry, which are seldom or never to be met with in prose. QUENCHED OF HOPE. Shakespeare.—SHORN OF HIS BEAMS. Milton.—*Created thing* NOR VALUED HE NOR SHUN'D. Milton.—*'Tis thus we riot, while* WHO SOW IT STARVE. Pope.—*This day* BE BREAD AND PEACE MY LOT. Pope.—INTO WHAT PIT THOU SEE'ST FROM WHAT HEIGHT FALLEN. Milton. *He deceived the mother of mankind.* WHAT TIME HIS PRIDE HAD CAST HIM *out of heaven.* Milton.—Some of these, with others to be found in Milton, seem to have been adopted for the sake of brevity, which in the poetical tongue is indispensable. For the same reason, perhaps the articles *a* and *the* are sometimes omitted by our poets, though less frequently in serious than burlesque composition.——In English, the adjective generally goes before the substantive, the nominative before the verb, and the active verb before (what we call) the accusative. Exceptions, however, to this rule, are not uncommon even in prose. But in poetry they are more frequent. *Their homely joys, and* DESTINY OBSCURE. *Now fades the glimmering landscape on the sight; and all the air a solemn stillness holds.* In general, that versification may be less difficult, and the cadence more uniformly pleasing; and sometimes, too, in order to give energy to expression, or vivacity to an image,—the English poet is permitted to take much greater liberties than the prose-writer, in arranging his words, and modulating his lines and periods. Examples may be seen in every page of Paradise Lost.

(2.) Some of our poetical words take an additional syllable, that they may suit the verse the better; as, *dispart, distain, disport, affright, enchain,* for part, stain, sport, fright, chain. Others seem to be nothing else than common words made shorter, for the convenience of the versifier. Such are, *auxiliar, sublunar, trump, vale, part, clime, submiss, frolic, plain, drear, dread, helm, morn, mead, eve* and *even, gan, illume* and *illumine, ope, hoar, bide, swage, scape;* for auxiliary, sublunary, trumpet, valley, depart, climate, submissive, frolicsome, complain, dreary, dreadful, helmet, morning, meadow, evening, began or began to, illuminate, open, hoary, abide, assuage, escape.——Of some of these the short form is the more ancient. In Scotland, *even, morn, bide, swage,* are still in vulgar use; but *morn,* except when contradistinguished to *even,* is synonymous, not with *morning* (as in the English poetical dialect), but with *morrow.* The Latin poets, in a way somewhat similar, and perhaps for a similar reason, shortened *fundamentum, tutamentum, munimentum,* &c. into fundamen, tutamen, munimen.

(3.) Of the following words, which are now almost peculiar to poetry, the greater part are ancient, and were once no doubt in common use in England, as many of them still are in Scotland. *Afield, amain, annoy* (a noun), *anon, aye* (ever), *behest, blithe, brand* (sword), *bridal, carol, dame* (lady), *featly, fell* (an adjective), *gaude, gore, host* (army), *lambkin, late* (of late), *lay* (poem), *lea, glade, gleam, hurl, lore, meed, orisons, plod,* (to travel laboriously), *ringlet, rue* (a verb), *ruth, ruthless, sojourn* (a noun), *smite, speed* (an active verb), *save* (except), *spray* (twig), *steed, strain* (song), *strand, swain, thrall, thrill, trail* (a verb), *troll, wail, welter, warble, wayward, woo, the while* (in the mean time), *yon, of yore.*

(4.) These that follow are also poetical; but, so far as appears, were never in common use. *Appal, arrowy, attune, battailous, breezy, car,* (chariot), *clarion, cates, courser, darkling, flicker, floweret, emblaze, gairish, circlet, impearl, nightly, noiseless, pinion* (wing), *shadowy, slumberous, streamy, troublous, wilder* (a verb), *shrill* (a verb), *shook* (shaken), *madding, viewless.*—The following, too, derived from the Greek and Latin, seem peculiar to poetry. *Clang, clangor, choral, bland, boreal, dire, ensanguined, ire, ireful, lave,* (to wash), *nymph,* (lady, girl), *orient, panoply, philomel, infuriate, jocund, radiant, rapt, redolent, refulgent, verdant, vernal, zephyr, zone* (girdle), *sylvan, suffuse.*

(5.) In most languages, the rapidity of pronunciation abbreviates some of the commonest words, or even joins two, or perhaps more, of them, into one; and some of these abbreviated forms find admission into writing. The English language was quite disfigured by them in the end of the last century; but Swift, by his satire and example brought them into disrepute: and, though some of them be retained in conversation, as *don't, shan't, can't,* they are now avoided in solemn style; and by elegant writers in general, except where the colloquial dialect is imitated, as in comedy. *'Tis* and *'twas,* since the time of Shaftesbury, seem to have been daily losing credit, at least in prose; but still have a place in poetry, perhaps because they contribute to conciseness. *'Twas on a lofty vase's side.* Gray.—*'Tis true, 'tis certain, man, though dead, retains part of himself.* Pope. In verse too, *over* may be shortened into *o'er,* (which is the Scotch, and probably was the old English pronunciation); *never* into *ne'er;* and from *the* and *to,* when they go before a word beginning with a vowel, the final letter is sometimes cut off. *O'er hills, o'er dales, o'er crags, o'er rocks they go.* Pope.—*Where'er she turns, the Graces homage pay. And all that beauty, all that wealth e'er gave. Rich with the spoils of time did ne'er unroll.* Gray.—*T'alarm th' eternal midnight of the grave*——These abbreviations are now peculiar to the poetical tongue, but not necessary to it. They sometimes promote brevity, and render versification less difficult.

48 to be used sparingly;

(6.) Those words which are commonly called *compound epithets*, as *rosy-finger'd*, *rosy-bosom'd*, *many-twinkling*, *many-sounding*, *moss-grown*, *bright-eyed*, *straw-built*, *spirit-stirring*, *incense-breathing*, *heaven-taught*, *love-whispering*, *lute-resounding*, are also to be considered as part of our poetical dialect. It is true, we have compounded adjectives in familiar use, as *high-seasoned*, *well-natured*, *ill-bred*, and innumerable others. But we speak of those that are less common, that seldom occur except in poetry, and of which in prose the use would appear affected. And that they sometimes promote brevity and vivacity of expression, cannot be denied. But as they give, when too frequent, a stiff and finical air to a performance; as they are not always explicit in the sense, nor agreeable in the sound; as they are apt to produce a confusion, or too great a multiplicity, of images; as they tend to disfigure the language, and furnish a pretext for endless innovation; they ought to be used sparingly; and those only used which the practice of popular authors has rendered familiar to the ear, and which are in themselves peculiarly emphatical and harmonious.

(7.) In the transformation of nouns into verbs and participles, our poetical dialect admits of greater latitude than prose. Hymn, pillow, curtain, story, pillar, picture, peal, surge, cavern, honey, career, cincture, bosom, sphere, are common nouns; but *to hymn*, *to pillow*, *curtained*, *pillared*, *pictured*, *pealing*, *surging*, *cavern'd*, *honied*, *careering*, *cinctured*, *bosomed*, *sphered*, would appear affected in prose, and yet in verse they are warranted by great authorities, though it must be confessed that they are censured by an able critic*, who had studied the English language, both poetical and prosaic, with wonderful diligence.

Some late poets, particularly the imitators of Spenser, have introduced a great variety of uncommon words, as certes, eftsoons, ne, whilom, transmew, moil, fone, losel, albe, hight, dight, pight, thews, couthful, assot, muchel, wend, arrear, &c. These were once poetical words, no doubt; but they are now obsolete, and to many readers unintelligible. No man of the present age, however conversant in this dialect, would naturally express himself in it on any interesting emergence; or, supposing this natural to the antiquarian, it would never appear so to the common hearer or reader. A mixture of these words, therefore, must ruin the pathos of modern language: and as they are not familiar to our ear, and plainly appear to be sought after and affected, will generally give a stiffness to modern versification. Yet in subjects approaching to the ludicrous they may have a good effect; as in the *Schoolmistress* of Shenstone, Parnel's Fairy-tale, Thomson's Castle of Indolence, and Pope's lines in the Dunciad upon Wormius. But this effect will be most pleasing to those who have least occasion to recur to the glossary.

Indeed, it is not always easy to fix the boundary between poetical and obsolete expressions. To many readers, *lore*, *meed*, *behest*, *blithe*, *gaude*, *spray*, *thrall*, may already appear antiquated; and to some the style of Spenser, or even of Chaucer, may be as intelligible as that of Dryden. This however we may venture to affirm, that a word, which the majority of readers cannot understand without a glossary, may with reason be considered as obsolete; and ought not to be used in modern composition, unless revived, and recommended to the public ear, by some very eminent writer. There are but few words in Milton, as *nathless*, *tine*, *frore*, *bosky*, &c.; there are but one or two in Dryden, as *falsify* (F); and in Pope, there are none at all, which every reader of our poetry may not be supposed to understand: whereas in Shakespeare, there are many, and in Spenser, many more, for which one who knows English very well may be obliged to consult the dictionary. The practice of Milton, Dryden, or Pope, may therefore, in almost all cases, be admitted as good authority for the use of a poetical word. And in them, all the words above enumerated, as poetical, and in present use, may actually be found. And of such poets as may choose to observe this rule, it will not be said, either that they reject the judgment of Quintilian, who recommends the newest of the old words, and the oldest of the new, or that they are inattentive to Pope's precept;

> Be not the first by whom the new are tried,
> Nor yet the last to lay the old aside.
>
> *Ess. on Crit.* v. 335.

We must not suppose that these poetical words never occur at all except in poetry. Even from conversation they are not excluded: and the ancient critics allow, that they may be admitted into prose, where they occasionally confer dignity upon a sublime subject, or heighten the ludicrous qualities of a mean one. But it is in poetry only where the frequent use of them does not savour of affectation.

Nor must we suppose them essential to this art. Many passages there are of exquisite poetry, wherein not a single phrase occurs that might not be used in prose. In fact, the influence of these words in adorning English verse is not very extensive. Some influence however they have. They serve to render the poetical style, first, more melodious; and, secondly, more solemn.

49 In which case they may render the poetical style more melodious.

First, They render the poetical style more melodious, and more easily reducible into measure. Words of unwieldy size, or difficult pronunciation, are never used by correct poets, where they can be avoided: unless in their sound they have something imitative of the sense. Homer's poetical inflections contribute wonderfully to the sweetness of his numbers: and if the reader is pleased to look back to the specimen above given of the English poetical dialect, he will find that the words are in general well sounding, and such as may coalesce with other words, without producing harsh combinations. Quintilian observes, that poets, for the sake of their verse, are indulged in many liberties, not granted to the orator, of lengthening, shortening, and dividing their words*:—and if the Greek and Roman poets claimed this indulgence

* *Johnson.*

* *Instit. Orat.* lib. x. cap. i. § 3.

(D) Dryden in one place (Æneid ix. verse 1095.) uses *Falsified* to denote *Pierced through and through*. He acknowledges, that this use of the word is an innovation; and has nothing to plead for it but his own authority, and that *Falsare* in Italian sometimes means the same thing.

Of Poetical Words.

gence from necessity, and obtained it, the English, those of them especially who write in rhyme, may claim it with better reason; as the words of their language are less musical and far less susceptible of variety in arrangement and syntax.

50
and solemn.

Secondly, Such poetical words as are known to be ancient have something venerable in their appearance, and impart a solemnity to all around them. This remark is from Quintilian; who adds, that they give to a composition that cast and colour of antiquity which in painting is so highly valued, but which art can never effectually imitate *. Poetical words that are either not ancient, or not known to be such, have, however, a pleasing effect from association. We are accustomed to meet with them in sublime and elegant writing; and hence they come to acquire sublimity and elegance: Even as the words we hear on familiar occasions come to be accounted familiar; and as those that take their rise among pick-pockets, gamblers, and gypsies, are thought too indelicate to be used by any person of taste or good manners. When one hears the following lines, which abound in poetical words,

> The breezy call of incense-breathing morn,
> The swallow twittering from the straw-built shed,
> The cock's shrill clarion, or the echoing horn,
> No more shall rouse them from their lowly bed:

—one is as sensible of the dignity of the language, as one would be of the vileness or vulgarity of that man's speech, who should prove his acquaintance with Bridewell, by interlarding his discourse with such terms as *milldoll*, *queer cull*, or *nobbing cheat* †; or who, in imitation of fops and gamblers, should on the common occasions of life, talk of being *beat hollow*, or *saving his distance* ‡. What gives dignity to persons gives dignity to language. A man of this character is one who has borne important employments, been connected with honourable associates, and never degraded himself by levity or immorality of conduct. Dignified phrases are those which have been used to express elevated sentiments, have always made their appearance in elegant composition, and have never been profaned by giving permanency or utterance to the passions of the vile, the giddy, or the worthless. And as by an active old age, the dignity of such men is confirmed and heightened; so the dignity of such words, if they be not suffered to fall into disuse, seldom fails to improve by length of time.

Art. II. Of Tropes and Figures.

51
Tropes and figures necessary to poetical language,

If it appear that, by means of figures, language may be made more *pleasing* and more natural than it would be without them; it will follow, that to poetic language, whose end is to *please* by imitating *nature*, figures must be not only ornamental, but necessary. It will here be proper, therefore, first to point out the importance and utility of figurative language; secondly, to show, that figures are more necessary to poetry in general than to any other mode of writing.

I. *As to the importance and utility of figurative expression*, in making language more pleasing and more natural; it may be remarked,

Of Tropes and Figures.

52
to supply the defects of simple language, and

(1.) That tropes and figures are often necessary to supply the unavoidable defects of language. When *proper* words are wanting, or not recollected, or when we do not choose to be always repeating them, we must have recourse to tropes and figures. When philosophers began to explain the operations of the mind, they found that most of the words in common use, being framed to answer the more obvious exigencies of life, were in their proper signification applicable to matter only and its qualities. What was to be done in this case? Would they think of making a new language to express the qualities of mind? No: that would have been difficult or impracticable; and granting it both practicable and easy, they must have foreseen, that nobody would read or listen to what was thus spoken or written in a new and consequently in an unknown tongue. They therefore took the language as they found it; and wherever they thought there was a similarity and analogy between the qualities of the mind and the qualities of matter, scrupled not to use the names of the material qualities tropically, by applying them to the mental qualities. Hence came the phrases *solidity* of judgment, *warmth* of imagination, *enlargement* of understanding, and many others; which, though figurative, express the meaning just as well as proper words would have done. In fact, numerous as the words in every language are, they must always fall short of the unbounded variety of human thoughts and perceptions. Tastes and smells are almost as numerous as the species of bodies. Sounds admit of perceptible varieties that surpass all computation, and the seven primary colours may be diversified without end. If each variety of external perception were to have a name, language would be insurmountably difficult; nay, if men were to appropriate a class of names to each particular sense, they would multiply words exceedingly, without adding any thing to the clearness of speech. Those words, therefore, that in their proper signification denote the objects of one sense, we often apply tropically to the objects of another, and say, Sweet taste, sweet smell, sweet sound; sharp point, sharp taste, sharp sound; harmony of sounds, harmony of colours, harmony of parts; soft silk, soft colour, soft sound, soft temper; and so in a thousand instances: and yet these words, in their tropical signification, are not less intelligible than in their proper one; for sharp taste and sharp sound, are as expressive as sharp sword; and harmony of tones is not better understood by the musician, than harmony of parts by the architect, and harmony of colours by the painter.

Savages, illiterate persons, and children, have comparatively but few words in proportion to the things they may have occasion to speak of; and must therefore recur to tropes and figures more frequently than persons of copious elocution. A seamen, or mechanic, even when he talks of that which does not belong to his art, borrows his language from that which does; and this makes his diction figurative to a degree that is sometimes entertaining enough. "Death (says a seaman in one of Smollet's novels) has not yet *boarded* my comrade; but they have been *yard-arm and yard-arm* these *three glasses*. His *starboard* eye is open, but fast *jammed* in his head; and the *haulyards* of his under jaw have given way." These phrases are exaggerated; but we allow them to be natural, because we know that illiterate people are apt to make use of tropes and figures taken from their own trade, even when they speak of things that are very remote and incongruous. In those poems, therefore, that imitate the conversation of illiterate persons, as in comedy, farce, and pastoral, such figures judiciously applied may render the imitation more pleasing, because more exact and natural.

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* Lib. viii. cap 3.

† See the *Scoundrel's Dictionary*.

‡ Language of New-market.

53 o avoid arshness of iction.

Words that are untuneable and harsh, the poet is often obliged to avoid, when perhaps he has no other way to express their meaning than by tropes and figures; and sometimes the measure of his verse may oblige him to reject a proper word that is not harsh, merely on account of its being too long, or too short, or in any other way unsuitable to the rhythm, or to the rhyme. And hence another use of figurative language, that it contributes to poetical harmony. Thus *to press the plain*, is frequently used to signify *to be slain in battle; liquid plain* is put for *ocean*, *blue serene* for *sky*, and *sylvan reign* for *country life*.

54 ropes and igures favourable to elicacy;

(2.) Tropes and figures are favourable to delicacy. When the proper name of a thing is in any respect unpleasant, a well chosen trope will convey the idea in such a way as to give no offence. This is agreeable, and even necessary, in polite conversation, and cannot be dispensed with in elegant writing of any kind. Many words, from their being often applied to vulgar use, acquire a meanness that disqualifies them for a place in serious poetry; while perhaps, under the influence of a different system of manners, the corresponding words in another language may be elegant, or at least not vulgar. When one reads Homer in the Greek, one takes no offence at his calling Eumeus by a name which, literally rendered, signifies *swine-herd;* first, because the Greek word is well-sounding in itself; secondly, because we have never heard it pronounced in conversation, nor consequently debased by vulgar use; and, thirdly, because we know, that the office denoted by it was, in the age of Eumeus, both important and honourable. But Pope would have been blamed, if a name so indelicate as *swine-herd* had in his translation been applied to so eminent a personage; and therefore he judiciously makes use of the trope *synecdoche*, and calls him *swain* *; a word both elegant and poetical, and not likely to lead the reader into any mistake about the person spoken of, as his employment had been described in a preceding passage. The same Eumeus is said, in the simple but melodious language of the original, to have been making his own shoes when Ulysses came to his door; a work which in those days the greatest heroes would often find necessary. This, too, the translator softens by a tropical expression:

> Here sat Eumeus, and his cares applied,
> To form strong *buskins* of well seasoned hide.

A hundred other examples might be quoted from this translation; but these will explain our meaning.

There are other occasions on which the delicacy of figurative language is still more needful; as in Virgil's account of the effects of animal love, and of the plague among the beasts, in the third Georgic; where Dryden's style, by being less figurative than the original, is in one place exceedingly filthy, and in another shockingly obscene.

Hobbes could construe a Greek author; but his skill in words must have been all derived from the dictionary; for he seems not to have known that any one articulate sound could be more agreeable, or any one phrase more dignified than another. In his Iliad and Odyssey, even when he hits the author's sense (which is not always the case), he proves, by his choice of words, that of harmony, elegance, or energy of style, he had no manner of conception. And hence that work, though called a *Translation of Homer*, does not even deserve the name of *poem;* because it is in every respect unpleasing, being nothing more than a fictitious narrative delivered in a mean prose, with the additional meanness of harsh rhyme and untuneable measure.—Trapp understood Virgil well enough as a grammarian, and had a taste for his beauties: yet his translation bears no resemblance to Virgil; which is owing to the same cause, an imprudent choice of words and figures, and a total want of harmony.

55 which, however, may be carried too far.

The delicacy we here contend for may, indeed, both in conversation and in writing, be carried too far. To call *killing an innocent man in a duel* an affair of honour, and *a violation of the rights of wedlock* an affair of gallantry, is a prostitution of figurative language. Nor is it any credit to us, that we are said to have upwards of 40 figurative phrases to express excessive drinking. Language of this sort generally implies, that the public abhorrence of such crimes is not so strong as it ought to be: and it is a question, whether even our morals might not be improved, if we were to call these and such like crimes by their proper names, *murder*, *adultery*, *drunkenness*, *gluttony;* names that not only express our meaning, but also betoken our disapprobation.—As to writing, it cannot be denied, that even Pope himself, in the excellent version just now quoted, has sometimes, for the sake of his numbers, or for fear of giving offence by too close an imitation of Homer's simplicity, employed tropes and figures too quaint or too solemn for the occasion. And the finical style is in part characterised by the writer's dislike to literal expressions, and affectedly substituting in their stead unnecessary tropes and figures. With these authors, a man's only child must always be his *only hope;* a country maid becomes *a rural beauty*, or perhaps a *nymph of the groves*; if flattery sing at all, it must be a *syren song;* the shepherd's flute dwindles into an *oaten reed*, and his crook is exalted into a *sceptre;* the *silver lilies* rise from their *golden beds*, and *languish* to the *complaining* gale. A young woman, though a good Christian, cannot make herself agreeable without *sacrificing to the Graces;* nor hope to do any execution among the *gentle swains*, till a whole legion of *Cupids*, armed with *flames* and *darts*, and other weapons, begin to discharge from her eyes their formidable artillery. For the sake of variety, or of the verse, some of these figures may now and then find a place in a poem; but in prose, unless very sparingly used, they favour of affectation.

56 Tropes and figures promote brevity, and

(3.) Tropes and figures promote brevity; and brevity, united with perspicuity, is always agreeable. An example or two will be given in the next paragraph. Sentiments thus delivered, and imagery, thus painted, are readily apprehended, by the mind, make a strong impression upon the fancy, and remain long in the memory; whereas too many words, even when the meaning is good, never fail to bring disgust and weariness. They argue a debility of mind which hinders the author from seeing his thoughts in one distinct point of view; and they also encourage a suspicion, that there is something faulty or defective in the matter. In the poetic style, therefore, which is addressed to the fancy and passions, and intended to make a vivid, a pleasing, and a permanent impression, brevity, and consequently tropes and figures, are indispensable. And a language will always be the better suited to poetical purposes, the more it admits of this brevity;—a character which is more conspicuous in the Greek and Latin than in any modern tongue, and much less in the French than in the Italian or English.

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* Odyssey, ook xiv. er. 41.

57
contribute to strength and energy of language.

(4.) Tropes and figures contribute to strength or energy of language, not only by their conciseness, but also by conveying to the fancy ideas that are easily comprehended, and make a strong impression. We are powerfully affected with what we see, or feel, or hear. When a sentiment comes enforced or illustrated by figures taken from objects of sight, or touch, or hearing, one thinks, as it were, that one sees, or feels, or hears, the thing spoken of; and thus, what in itself would perhaps be obscure, or is merely intellectual, may be made to seize our attention and interest our passions almost as effectually as if it were an object of outward sense. When Virgil calls the Scipios *thunderbolts of war*, he very strongly expresses in one word, and by one image, the rapidity of their victories, the noise their achievements made in the world, and the ruin and consternation that attended their irresistible career.—When Homer calls Ajax *the bulwark of the Greeks*, he paints with equal brevity his vast size and strength, the difficulty of prevailing against him, and the confidence wherewith his countrymen reposed on his valour.—When Solomon says of the strange woman, or harlot, that "her feet go *down* to death," he lets us know, not only that her path ends in destruction, but also, that they who accompany her will find it easy to go forwards to ruin, and difficult to return to their duty.—Satan's enormous magnitude, and refulgent appearance, his perpendicular ascent through a region of darkness, and the inconceivable rapidity of his motion, are all painted out to our fancy by Milton, in one very short similitude,

> Sprung upward, like—a pyramid of fire.
> *Par. Lost*, iv. 1013.

To take in the full meaning of which figure, we must imagine ourselves in chaos, and a vast luminous body rising upwards, near the place where we are, so swiftly as to appear a continued track of light, and lessening to the view according to the increase of distance, till it end in a point, and then disappear; and all this must be supposed to strike our eye at one instant.——Equal to this in propriety, though not in magnificence, is that allegory of Gray,

> The paths of glory lead but to the grave:

Which presents to the imagination a wide plain, where several roads appear, crowded with glittering multitudes, and issuing from different quarters, but drawing nearer and nearer as they advance, till they terminate in the dark and narrow house, where all their glories enter in succession, and disappear for ever.——When it is said in Scripture, of a good man who died, that he *fell asleep*, what a number of ideas are at once conveyed to our imagination, by this beautiful and expressive figure: As a labourer, at the close of day, goes to sleep, with the satisfaction of having performed his work, and with the agreeable hope of awaking in the morning of a new day, refreshed and cheerful; so a good man, at the end of life, resigns himself calm and contented to the will of his Maker, with the sweet reflection of having endeavoured to do his duty, and with the transporting hope of soon awaking in the regions of light, to life and happiness eternal. The figure also suggests, that to a good man the transition from life to death is, even in the sensation, no more painful, than when our faculties melt away into the pleasing insensibility of sleep.——Satan, flying among the stars, is said by Milton to "*sail* between worlds and worlds;" which has an elegance and force far superior to the proper word *fly*. For by this allusion to a ship, we are made to form a lively idea of his great size, and to conceive of his motion, that it was equable and majestic.——Virgil uses a happy figure to express the size of the great wooden horse, by means of which the Greeks were conveyed into Troy: "Equum divina Palladis arte *ædificant*."——Milton is still bolder when he says,

> Who would not sing for Lycidas! he knew
> Himself to sing, and *build the lofty rhyme*.

The phrase, however, though bold, is emphatical; and gives a noble idea of the durability of poetry, as well as of the art and attention requisite to form a good poem.——There are hundreds of tropical expressions in common use, incomparably more energetic than any proper words of equal brevity that could be put in their place. A cheek *burning* with blushes, is a trope which at once describes the colour as it appears to the beholder, and the glowing heat as it is felt by the person blushing. *Chilled* with despondence, *petrified* with astonishment, *thunderstruck* with disagreeable and unexpected intelligence, *melted* with love or pity, *dissolved* in luxury, *hardened* in wickedness, *softening* into remorse, *inflamed* with desire, *tossed* with uncertainty, &c.—every one is sensible of the force of these and the like phrases, and that they must contribute to the energy of composition.

58
They are likewise the language of strong passion.

(5.) Tropes and figures promote strength of expression; and are in poetry peculiarly requisite, because they are often more *natural*, and more *imitative*, than proper words. In fact, this is so much the case, that it would be impossible to imitate the language of passion without them. It is true, that when the mind is agitated, one does not run out into allegories, or long-winded similitudes, or any of the figures that require much attention and many words, or that tend to withdraw the fancy from the object of the passion. Yet the language of many passions must be figurative notwithstanding; because they rouse the fancy, and direct it to objects congenial to their own nature, which diversify the language of the speaker with a multitude of allusions. The fancy of a very angry man, for example, presents to his view a train of disagreeable ideas connected with the passion of anger, and tending to encourage it; and if he speak without restraint during the paroxysm of his rage, those ideas will force themselves upon him, and compel him to give them utterance. "Infernal monster! (he will say),—my blood boils at him: he has used me like a dog; never was man so injured as I have been by this barbarian. He has no more sense of propriety than a stone. His countenance is diabolical, and his soul as ugly as his countenance. His heart is cold and hard, and his resolutions dark and bloody," &c. This speech is wholly figurative. It is made up of *metaphors* and *hyperboles*, which, with the *prosopopeia* and *apostrophe*, are the most passionate of all the figures. Lear, driven out of doors by his unnatural daughters, in the midst of darkness, thunder, and tempest, naturally

rally breaks forth (for his indignation is just now raised to the very highest pitch) into the following violent exclamation against the crimes of mankind, in which almost every word is figurative.

Tremble, thou wretch,
That hast within thee undivulged crimes
Unwhipt of justice. Hide thee, thou bloody hand,
Thou perjur'd, and thou simular of virtue,
That art incestuous. Caitiff, to pieces shake,
That under covert, and convenient seeming,
Hast practis'd on man's life. Close pent-up guilts,
Rive your concealing continents, and cry
These dreadful summoners grace. *King Lear.*

——The vehemence of maternal love, and sorrow from the apprehension of losing her child, make the Lady Constance utter a language that is strongly figurative, though quite suitable to the condition and character of the speaker. The passage is too long for a quotation, but concludes thus:

O Lord! my boy, my Arthur, my fair son,
My life, my joy, my food, my all the world,
My widow-comfort, and my sorrow's cure. *King John.*

——Similar to this, and equally expressive of conjugal love, is that beautiful hyperbole in Homer; where Andromache, to dissuade her husband from going out to the battle, tells him that she had now no mother, father or brethren, all her kindred being dead, and her native country desolate; and then tenderly adds,

But while my Hector yet survives, I see
My father, mother, brethren, all in thee. *Iliad*, b. vi.

59
The simplest language most suitable to depressing passions,

As the passions that agitate the soul, and rouse the fancy, are apt to vent themselves in tropes and figures, so those that depress the mind adopt for the most part a plain diction, without any ornament: for to a dejected mind, wherein the imagination is generally inactive, it is not probable that any great variety of ideas will present themselves; and when these are few and familiar, the words that express them must be simple. As no author equals Shakespeare in boldness or variety of figures when he copies the style of those violent passions that stimulate the fancy; so, when we would exhibit the human mind in a dejected state, no uninspired writer excels him in simplicity. The same Lear whose resentment had impaired his understanding, while it broke out in the most boisterous language, when, after some medical applications, he recovers his reason, his rage being now exhausted, his pride humbled, and his spirits totally depressed, speaks in a style than which nothing can be imagined more simple or more affecting.

Pray, do not mock me:
I am a very foolish, fond old man,
Fourscore and upward; and, to deal plainly with you,
I fear I am not in my perfect mind.
Methinks I should know you, and know this man;
Yet I am doubtful: for I am mainly ignorant
What place this is; and all the skill I have
Remembers not these garments: nor I know not
Where I did lodge last night. *Lear*, act iv. sc. 7.

——Desdemona, ever gentle, artless, and sincere, shocked at the unkindness of her husband, and overcome with melancholy, speaks in a style so beautifully simple, and so perfectly natural, that one knows not what to say in commendation of it:

My mother had a maid call'd Barbara;
She was in love, and he she lov'd prov'd false,
And did forsake her. She had a song of willow;
An old thing it was, but it express'd her fortune,
And she died singing it. That song to-night
Will not go from my mind: I have much to do,
But to go hang my head all at one side,
And sing it like poor Barbara. *Othello*, act iv. sc. 3.

60
and to the sentiment of admiration.

Sometimes the imagination, even when exerted to the utmost, takes in but few ideas. This happens when the attention is totally engrossed by some very great object; admiration being one of those emotions that rather suspend the exercise of the faculties than push them into action. And here, too, the simplest language is the most natural; as when Milton says of the Deity, that he sits high-throned above all height." And as this simplicity is more suitable to that one great exertion which occupies the speaker's mind than a more elaborate imagery or language would have been, so has it also a more powerful effect in fixing and elevating the imagination of the hearer; for to introduce other thoughts for the sake of illustrating what cannot be illustrated, could answer no other purpose than to draw off the attention from the principal idea. In these and the like cases, the fancy left to itself will have more satisfaction in pursuing at leisure its own speculations that in attending to those of others; as they who see for the first time some admirable object would choose rather to feast upon it in silence, than to have their thoughts interrupted by a long description from another person, informing them of nothing but what they see before them, are already acquainted with, or may easily conceive.

It was remarked above that the *hyperbole*, *prosopopeia*, and *apostrophe*, are among the most passionate figures. This deserves illustration.

61
Hyperbole natural to the passion of anger, love, fear, &c.

1st, A very angry man is apt to think the injury he has just received greater than it really is; and if he proceed immediately to retaliate by word or deed, seldom fails to exceed the due bounds, and to become injurious in his turn. The fond parent looks upon his child as a prodigy of genius and beauty; and the romantic lover will not be persuaded that his mistress has nothing supernatural either in her mind or person. Fear, in like manner, not only magnifies its object when real, but even forms an object out of nothing, and mistakes the fictions of fancy for the intimations of sense.—No wonder, then, that they who speak according to the impulse of passion should speak *hyperbolically;* that the angry man should exaggerate the injury he has received, and the vengeance he is going to inflict; that the sorrowful should magnify what they have lost, and the joyful what they have obtained; that the lover should speak extravagantly of the beauty of his mistress, the coward of the dangers he has encountered, and the credulous clown of the miracles performed by the juggler. In fact, these people would not do justice to what they feel if they did not say more than the truth. The valiant man, on the other hand, as naturally adopts the diminishing hyperbole when he speaks of danger; and the man of sense, when he is obliged to mention his own virtue or ability; because it appears to him, or he is willing to
consider

consider it, as less than the truth, or at best as inconsiderable. Contempt uses the same figure; and therefore Petruchio, affecting that passion, affects also the language of it:

> Thou liest, thou thread, thou thimble,
> Thou yard, three-quarters, half-yard, quarter, nail,
> Thou flea, thou nit, thou winter-cricket, thou!
> Brav'd in mine own house with a skein of thread!
> Away, thou rag, thou quantity, thou remnant!
>
> *Taming of the Shrew*, act iv. sc. 1.

For some passions consider their objects as important and others as unimportant. Of the former sort are anger, love, fear, admiration, joy, sorrow, pride; of the latter are contempt and courage. Those may be said to subdue the mind to the object, and these to subdue the object to the mind. And the former, when violent, always magnify their objects: whence the hyperbole called amplification, or *auxesis:* and the latter as constantly diminish theirs; and give rise to the hyperbole called *meiosis*, or diminution.—Even when the mind cannot be said to be under the influence of any violent passion, we naturally employ the same figure when we would impress another very strongly with any idea. "He is a walking shadow: he is worn to skin and bone: he has one foot in the grave and the other following:"—these, and the like phrases, are proved to be natural by their frequency. By introducing great ideas, the hyperbole is further useful in poetry as a source of the sublime; but when employed injudiciously is very apt to become ridiculous. Cowley makes Goliah as big as the hill down which he was marching *; and tells us, that when he came into the valley he seemed to fill it, and to overtop the neighbouring mountains (which, by the by, seems rather to lessen the mountains and valleys than to magnify the giant): nay, he adds that the sun started back when he saw the splendour of his arms. This poet seems to have thought that the figure in question could never be sufficiently enormous; but Quintilian would have taught him, "Quamvis omnis hyperbole ultra fidem, non tamen esse debet ultra modum." The reason is, that this figure, when excessive, betokens rather absolute infatuation than intense emotion; and resembles the efforts of a ranting tragedian, or the ravings of an enthusiastic declaimer, who, by putting on the gestures and looks of a lunatic, satisfy the discerning part of their audience, that, instead of feeling strongly, they have no rational feelings at all. In the wildest energies of nature there is a modesty which the imitative artist will be careful never to overstep.

62
Prosopopœia, when proper.

2dly, That figure, by which things are spoken of as if they were persons, is called *prosopopœia*, or *personification.* It is a bold figure, and yet is often natural. Long acquaintance recommends to some share in our affection even things inanimate, as a house, a tree, a rock, a mountain, a country; and were we to leave such a thing without hope of return, we should be inclined to address it with a farewel, as if it were a percipient creature. Hence it was that Mary queen of Scotland, when on her return to her own kingdom, so affectionately bade adieu to the country which she had left. "Farewel France," said she, "farewel, beloved country, which I shall never more behold!" Nay, we find that ignorant nations have actually worshipped such things, or considered them as the haunt of certain powerful beings. Dryads and hamadryads were by the Greeks and Romans supposed to preside over trees and groves; river gods and nymphs, over streams and fountains; little deities, called *Lares* and *Penates*, were believed to be the guardians of hearths and houses. In Scotland there is hardly a hill remarkable for the beauty of its shape, that was not in former times thought to be the habitation of fairies. Nay, modern as well as ancient superstition has appropriated the waters to a peculiar sort of demon or goblin, and peoples the very regions of death, the tombs and charnel houses, with multitudes of ghosts and phantoms.—Besides when things inanimate make a strong impression upon us, whether agreeable or otherwise, we are apt to address them in terms of affection or dislike. The sailor blesses the plank that brought him ashore from the shipwreck; and the passionate man, and sometimes even the philosopher, will say bitter words to the stumbling block that gave him a fall.—Moreover, a man agitated with an interesting passion, especially of long continuance, is apt to fancy that all nature sympathises with him. If he has lost a beloved friend, he thinks the sun less bright than at other times; and in the sighing of the winds and groves, in the lowings of the herd, and in the murmurs of the stream, he seems to hear the voice of lamentation. But when joy or hope predominate, the whole world assumes a gay appearance. In the contemplation of every part of nature, of every condition of mankind, of every form of human society, the benevolent and the pious man, the morose and the cheerful, the miser and the misanthrope, finds occasion to indulge his favourite passion, and sees or thinks he sees, his own temper reflected back in the actions, sympathies, and tendencies of other things and persons. Our affections are indeed the medium through which we may be said to survey ourselves, and every thing else; and whatever be our inward frame, we are apt to perceive a wonderful congeniality in the world without us. And hence the fancy, when roused by real emotions, or by the pathos of composition, is easily reconciled to those figures of speech that ascribe sympathy, perception, and the other attributes of animal life, to things inanimate, or even to notions merely intellectual.—Motion, too, bears a close affinity to action, and affects our imagination nearly in the same manner; and we see a great part of nature in motion, and by its sensible effects are led to contemplate energies innumerable. These conduct the rational mind to the Great First Cause; and these, in times of ignorance, disposed the vulgar to believe in a variety of subordinate agents employed in producing those appearances that could not otherwise be accounted for. Hence an endless train of fabulous deities, and of witches, demons, fairies, genii; which, if they prove our reason weak, and our fancy strong, prove also that personification is natural to the human mind; and that a right use of this figure may have a powerful effect, in fabulous writing especially, to engage our sympathy in behalf of things as well as persons; for nothing can give lasting delight to a moral being, but that which awakens sympathy, and touches the heart; and though it be true that we sympathise in some degree even with inanimate things, yet what has, or is supposed to have, life, calls forth a more sincere and more permanent fellow-feeling.—Let it be observed further, that to awaken our sympathetic feelings, a lively conception of their object is necessary. This indeed is true of almost all our emotions; their keenness is in proportion

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* *Davideis*, book iii.

portion to the vivacity of the perceptions that excite them. Distress that we see is more affecting than what we only hear of*; a perusal of the gayest scenes in a comedy does not rouse the mind so effectually as the presence of a cheerful companion; and the death of a friend is of greater energy in producing seriousness, and the consideration of our latter end, than all the pathos of Young. Of descriptions addressed to the fancy, those that are most vivid and picturesque will generally be found to have the most powerful influence over our affections; and those that exhibit persons engaged in action, and adorned with visible insignia, give a brisker impulse to the faculties than such as convey intellectual ideas only, or images taken from still life. No abstract notion of time, or of love, can be so striking to the fancy as the image of an old man accoutred with a scythe, or of a beautiful boy with wings and a bow and arrows: and no physiological account of frenzy could suggest so vivid an idea as the poet has given us in that exquisite portrait,

And moody madness laughing wild amid severest wo.

And for this reason partly it is that the epic poet, in order to work the more effectually upon our passions and imagination, refers the secret springs of human conduct, and the vicissitudes of human affairs, to the agency of personified causes; that is, to the machinery of gods and goddesses, angels, demons, magicians, and other powerful beings. And hence, in all sublime poetry, life and motion, with their several modes and attributes, are liberally bestowed on those objects wherewith the author intends that we should be strongly impressed: scenes perfectly inanimate and still, tending rather to diffuse a languor over the mind than to communicate to our internal powers those lively energies without which a being essentially active can never receive complete gratification. —Lastly, some violent passions are peculiarly inclined to change things into persons. The horrors of his mind haunted Orestes in the shape of furies. Conscience, in the form of the murdered person, stares the murderer in the face, and often terrifies him to distraction. The superstitious man, travelling alone in the dark, mistakes a white stone for a ghost, a bush for a demon, a tree waving with the wind for an enormous giant brandishing a hundred arms. The lunatic and enthusiast converse with persons who exist only in their own distempered fancy; and the glutton and the miser, if they were to give utterance to all their thoughts, would often, it is presumable, speak, the one of his gold, the other of his belly, not only as a person, but as a god,—the object of his warmest love and most devout regard.—More need not be said to prove that personification is natural, and may frequently contribute to the pathos, energy, and beauty of poetic language.

63
Apostrophe how to be used.

3dly, *Apostrophe*, or a sudden diversion of speech from one person to another person or thing, is a figure nearly related to the former. Poets sometimes make use of it, in order to help out their verse, or merely to give variety to their style: but on these occasions it is to be considered as rather a trick of art, than an effort of nature. It is most natural, and most pathetic, when the person or thing to whom the apostrophe is made, and for whose sake we give a new direction to our speech, is in our eyes eminently distinguished for good or evil, or raises within us some sudden and powerful emotion, such as the hearer would acquiesce in, or at least acknowledge to be reasonable. But this, like the other pathetic figures, must be used with great prudence. For if, instead of calling forth the hearer's sympathy, it should only betray the levity of the speaker, or such wanderings of his mind as neither the subject nor the occasion would lead one to expect, it will then create disgust instead of approbation. The orator, therefore, must not attempt the passionate apostrophe, till the minds of the hearers be prepared to join in it. And every audience is not equally obsequious in this respect. In the forum of ancient Rome that would have passed for sublime and pathetic, which in the most respectable British auditories would appear ridiculous. For our style of public speaking is cool and argumentative; and partakes less of enthusiasm than the Roman did, and much less than the modern French or Italian. Of British eloquence, particularly that of the pulpit, the chief recommendations are gravity and simplicity. And it is vain to say, that our oratory *ought* to be more vehement: for that matter depends on causes, which it is not only inexpedient, but impossible to alter; namely, on the character and spirit of the people, and their rational notions in regard to religion, policy, and literature. The exclamations of Cicero would weigh but little in our parliament; and many of those which we meet with in French sermons would not be more effectual if attempted in our pulpit. To see one of our preachers, who the moment before was a cool reasoner, a temperate speaker, an humble Christian, and an orthodox divine, break out into a sudden apostrophe to the immortal powers, or to the walls of the church, tends to force a smile, rather than a tear, from those among us who reflect, that there is nothing in the subject, and should be nothing in the orator, to warrant such wanderings of fancy or vehemence of emotion. If he be careful to cultivate a pure style, and a grave and graceful utterance, a British clergyman, who speaks from conviction the plain unaffected words of truth and soberness, of benevolence and piety, will, it is believed, convey more pathetic, as well as more permanent, impressions to the heart, and be more useful as a Christian teacher, than if he were to put in practice all the attitudes of Roscius, and all the tropes and figures of Cicero.

But where the language of passion and enthusiasm is permitted to display itself, whatever raises any strong emotion, whether it be animate or inanimate, absent or present, sensible or intellectual, may give rise to the apostrophe. A man in a distant country, speaking of the place of his birth, might naturally exclaim, "O my dear native land, shall I never see thee more!" Or, when some great misfortune befals him, "Happy are ye, O my parents, that ye are not alive to see this." We have a beautiful apostrophe in the third book of the Æneid, where Æneas who is telling his story to Dido, happening to mention the death of his father, makes a sudden address to him as follows:

———hic, pelagi tot tempestatibus actus,
Heu, genitorem, omnis curæ casusque levamen,
Amitto Anchisen:—hic me, pater optime, fessum
Deseris, heu, tantis nequicquam erepte periclis!

This apostrophe has a pleasing effect. It seems to intimate, that the love which the hero bore his father was so great, that when he mentioned him he forgot every thing else; and, without minding his company, one of whom was a queen, suddenly addressed himself to that which, though present only in idea, was still a principal object of his affection. An emotion so warm and so reasonable cannot fail to command the sympathy of the reader.——When Michael, in the eleventh book of Paradise Lost, announces to Adam and Eve the necessity of their immediate departure from the garden of Eden, the poet's art in preserving the decorum of the two characters is very remarkable. Pierced to the heart at the thought of leaving that happy place, Eve, in all the violence of ungovernable sorrow, breaks forth into a pathetic apostrophe to Paradise, to the flowers she had reared, and to the nuptial bower she had adorned. Adam makes no address to the walks, the trees, or the flowers of the garden, the loss whereof did not so much afflict him; but, in his reply to the Archangel, expresses, without a figure, his regret for being banished from a place where he had been so often honoured with a sensible manifestation of the divine presence. The use of the apostrophe in the one case, and the omission of it in the other, not only gives a beautiful variety to the style, but also marks that superior elevation and composure of mind, by which the poet had all along distinguished the character of Adam.—One of the finest applications of this figure that is anywhere to be seen, is in the fourth book of the same poem; where the author, catching by sympathy the devotion of our first parents, suddenly drops his narrative, and joins his voice to theirs in adoring the Father of the universe.

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* Hor. Ar. Poet. v. 180.

Thus at their shady lodge arriv'd, both stood,
Both turn'd, and under open sky ador'd
The God that made both sky, air, earth, and heav'n,
Which they beheld, the moon's resplendent globe,
And starry pole:—Thou also mad'st the night,
Maker omnipotent! and thou the day,
Which we in our appointed work employ'd
Have finish'd.————

Milton took the hint of this fine contrivance from a well-known passage of Virgil:

Hic juvenum chorus, ille senum; qui carmine laudes
Herculeas et facta ferant;————
————ut duros mille labores
Rege sub Eurystheo, fatis Junonis iniquæ,
Pertulerit:—Tu nubigenas, invicte, bimembres,
Hylæumque, Pholumque manu, tu Cresia mactas
Prodigia.————

The beauty arising from diversified composition is the same in both, and very great in each. But every reader must *feel*, that the figure is incomparably more affecting to the mind in the imitation than in the original. So true it is, that the most rational emotions raise the most intense fellow-feeling; and that the apostrophe is then the most emphatical, when it displays those workings of human affection which are at once ardent and well-founded.

64
Tropes and figures are useful, as they suggest an endless variety of agreeable images.

To conclude this head: Tropes and figures, particularly the *metaphor*, *similitude*, and *allegory*, are further useful in beautifying language, by suggesting, together with the thoughts essential to the subject, an endless variety of agreeable images, for which there would be no place, if writers were always to confine themselves to the *proper* names of things. And this beauty and variety, judiciously applied, is so far from distracting, that it tends rather to fix the attention, and captivate the heart of the readers, by giving light, and life, and pathos, to the whole composition.

II. That tropes and figures are more necessary to poetry, than to any other mode of writing, was the second point proposed to be illustrated in this section.

65
Tropes and figures more necessary to poetry than to any other mode of writing.

Language, as already observed, is then natural, when it is suitable to the supposed condition of the speaker. Figurative language is peculiarly suitable to the supposed condition of the poet; because figures are suggested by the fancy; and the fancy of him who composes poetry is more employed than that of any other author. Of all historical, philosophical, and theological researches, the object is *real* truth, which is fixed and permanent. The aim of rhetorical declamation (according to Cicero) is *apparent* truth; which, being less determinate, leaves the fancy of the speaker more free, gives greater scope to the inventive powers, and supplies the materials of a more figurative phraseology. But the poet is subject to no restraints, but those of verisimilitude; which is still less determinate than rhetorical truth. He seeks not to convince the judgment of his reader by arguments of either real or apparent cogency; he means only to please and interest him, by an appeal to his sensibility and imagination. His own imagination is therefore continually at work, ranging through the whole of real and probable existence, "glancing from heaven to earth, from earth to heaven," in quest of images and ideas suited to the emotions he himself feels, and to the sympathies he would communicate to others. And, consequently, figures of speech, the offspring of excursive fancy, must (if he speak according to what he is supposed to think and feel, that is, according to his supposed condition) tincture the language of the poet more than that of any other composer. So that, if figurative diction be unnatural in geometry, because all wanderings of fancy are unsuitable, and even impossible to the geometrician, while intent upon his argument; it is, upon the same principle, perfectly natural, and even unavoidable, in poetry; because the more a poet attends to his subject, and the better qualified he is to do it justice, the more active will his imagination be, and the more diversified the ideas that present themselves to his mind.——Besides, the true poet addresses himself to the passions and sympathies of mankind; which, till his own be raised, he cannot hope to do with success. And it is the nature of many passions, though not of all, to increase the activity of imagination: and an active imagination naturally vents itself in figurative language; nay, unless restrained by a correct taste, has a tendency to exceed in it; of which Bishop Taylor and Lord Verulam, two geniuses different in kind, but of the highest order, are memorable examples.

We said, that "the poet seeks not to convince the judgment of his reader by arguments of either real or apparent cogency."——We do not mean, that in poetry argument has no place. The most legitimate reasoning, the soundest philosophy, and narratives purely historical, may appear in a poem, and contribute greatly to the honour of the author, and to the importance of his work. All this we have in Paradise Lost. We mean, that what distinguishes *pure* poetry from other writing, is its aptitude, not to sway the judgment by reasoning,

soning, but to please the fancy and move the passions, by a lively imitation of nature. Nor would we exclude poetical embellishment from history, or even from philosophy. Plato's Dialogues and the Moral Essays of Addison and Johnson abound in poetic imagery; and Livy and Tacitus often amuse their readers with poetical description. In like manner, though geometry and physics be different sciences; though abstract ideas be the subject, and pure demonstration or intuition the evidence, of the former; and though the material universe, and the informations of sense, be the subject and the evidence of the latter; yet have these sciences been united by the best philosophers, and very happy effects resulted from the union.——In one and the same work, poetry, history, philosophy, and oratory, may doubtless be blended; nay, these arts have all been actually blended in one and the same work, not by Milton only, but also by Homer, Virgil, Lucan, and Shakespeare. Yet still these arts are different; different in their ends and principles, and in the faculties of the mind to which they are respectively addressed: and it is easy to perceive when a writer employs one and when another.

§ 2. *Of the* Sound *of Poetical Language.*

66 The poet ought to attend to the harmony of language, which consists in

As the ear, like every other perceptive faculty, is capable of gratification, regard is to be had to the sound of words, even in prose. But to the harmony of language, it behoves the poet, more than any other writer, to attend; as it is more especially his concern to render his work pleasurable. In fact, we find, that no poet was ever popular who did not possess the art of harmonious composition.

What belongs to the subject of Poetical Harmony may be referred to one or other of these heads, *Sweetness*, *Measure*, and *Imitation*.

67 sweetness and

I. In order to give *sweetness* to language, either in verse or prose, all words of harsh sound, difficult pronunciation, or unwieldy magnitude, are to be avoided as much as possible, unless when they have in the sound something peculiarly emphatical; and words are to be so placed in respect of one another, as that discordant combinations may not result from their union. But in poetry this is more necessary than in prose; poetical language being understood to be an imitation of natural language improved to that perfection which is consistent with probability. To poetry, therefore, a greater latitude must be allowed than to prose, in expressing, by tropes and figures of pleasing sound, those ideas whereof the proper names are in any respect offensive, either to the ear or to the fancy.

II. How far versification or *regular measure* may be essential to this art, has been disputed by critical writers; some holding it to be indispensably necessary, and some not necessary at all.

68 measure, which, though not essential,

The fact seems to be as already hinted, that to poetry verse is not essential. In a prose work, we may have the fable, the arrangement, and a great deal of the pathos and language, of poetry; and such a work is certainly a poem, though perhaps not a perfect one. For how absurd would it be to say, that by changing the position only of a word or two in each line, one might divest Homer's Iliad of the poetical character! At this rate, the arts of poetry and versification would be the same; and the rules in Despauter's Grammar, and the moral distichs ascribed to Cato, would be as real poetry as any part of Virgil. In fact, some very ancient poems, when translated into a modern tongue, are far less poetical in verse than in prose; the alterations necessary to adapt them to our numbers being detrimental to their sublime simplicity; of which any person of taste will be sensible, who compares our common prose-version of Job, the Psalms, and the Song of Solomon, with the best metrical paraphrase of those books that has yet appeared. Nay, in many cases, Comedy will be more poetical, because more pleasing and natural, in prose than in verse. By versifying Tom Jones, and The Merry Wives of Windsor, we should spoil the two finest comic poems, the one epic, the other dramatical, now in the world.

69 adds to the perfection of poetry.

But, secondly, though verse be not essential to poetry, it is necessary to the perfection of all poetry that admits of it. Verse is to poetry, what colours are to painting (G.) A painter might display great genius, and draw masterly figures with chalk or ink; but if he intend a perfect picture, he must employ in his work as many colours as are seen in the object he imitates. Or, to adopt a beautiful comparison of Demosthenes, quoted by Aristotle *, "Versification is to poetry what bloom is to the human countenance." A good face is agreeable when the bloom is gone, and good poetry may please without versification; harmonious numbers may set off an indifferent poem, and a fine bloom indifferent features: but, without verse, poetry is incomplete; and beauty is not perfect, unless to sweetness and regularity of feature there be superadded

> The bloom of young desire, and purple light of love.

If numbers be necessary to the perfection of the higher poetry, they are no less so to that of the lower kinds, to Pastoral, Song, and Satire, which have little besides the language and versification to distinguish them from prose; and which some ancient authors are unwilling to admit to the rank of poems: though it seems too nice a scruple, both because such writings are commonly termed *poetical*; and also because there is, even in them, something that may not improperly be considered as an imitation of nature.

That the rhythm and measure of verse are naturally agreeable, and therefore that by these poetry may be made more pleasing than it would be without them, is evident from this, that children and illiterate people, whose admiration we cannot suppose to be the effect of habit or prejudice, are exceedingly delighted with them. In many proverbial sayings, where there is neither rhime, nor alliteration, rhythm is obviously studied. Nay, the use of rhythm in poetry is universal; whereas alliteration and

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* *Rhetor.* lib iii. cap. 4.

(G) Horace seems to hint at the same comparison, when, after specifying the several sorts of verse suitable to Epic, Elegiac, Lyric, and Dramatic Poetry, he adds,

> Descriptas servare vices, *operumque colores*.
> Cur ego, si nequeo ignoroque, Poeta salutor? *Ar. Poet.* ver. 86.

and rhime, though relished by some nations, are not much sought after by others. And we need not be at a loss to account for the agreeableness of proportion and order, if we reflect, that they suggest the agreeable ideas of contrivance and skill, at the same time that they render the connection of things obvious to the understanding, and imprint it deeply on the memory. Verse, by promoting distinct and easy remembrance, conveys ideas to the mind with energy, and enlivens every emotion the poet intends to raise in the hearer or reader. Besides, when we attend to verses, after hearing one or two, we become acquainted with the measure, which, therefore, we always look for in the sequel. This perpetual interchange of hope and gratification is a source of delight; and to this in part is owing the pleasure we take in the rhimes of modern poetry. And hence we see, that though an incorrect rhime or untuneable verse be in itself, and compared with an important sentiment, a very trifling matter; yet it is no trifle in regard to its effects on the hearer; because it brings disappointment, and so gives a temporary shock to the mind, and interrupts the current of the affections: and because it suggests the disagreeable ideas of negligence or want of skill on the part of the author. And therefore, as the public ear becomes more delicate, the negligence will be more glaring, and the disappointment more intensely felt; and correctness of rhime and of measure will of course be the more indispensible. In our tongue, rhime is more necessary to Lyric than to Heroic poetry. The reason seems to be, that in the latter the ear can of itself perceive the boundary of the measure, because the lines are all of equal length nearly, and every good reader makes a short pause at the end of each; whereas, in the former, the lines vary in length: and therefore the rhime is requisite to make the measure and rhythm sufficiently perceptible. Custom, too, may have some influence. English Odes without rhime are uncommon; and therefore have something awkward about them, or something at least to which the public ear is not yet thoroughly reconciled. Indeed, when the drama is excepted, we do not think that rhime can be safely spared from English poetry of any kind, but when the subject is able to support itself. "He that thinks himself capable of astonishing (says Johnson) may write blank verse; but those that hope only to please, must condescend to rhime."

70
In what cases rhime may be dispensed with in English poetry.

Rhime, however, is of less importance by far than rhythm, which in poetry as well as in music is the source of much pleasing variety; of variety tempered with uniformity, and regulated by art; insomuch that, notwithstanding the likeness of one hexameter verse to another, it is not common, either in Virgil or Homer, to meet with two contiguous hexameters whose rhythm is exactly the same. And though all English heroic verses consist of five feet, among which the iambic predominates; yet this measure, in respect of rhythm alone, is susceptible of more than 30 varieties. And let it be remarked further, that different kinds of verse, by being adapted to different subjects and modes of writing, give variety to the poetic language, and multiply the charms of this pleasing art.

What has formerly been shown to be true in regard to style, will also in many cases hold true of versification, "that it is then *natural* when it is adapted to the *supposed condition* of the speaker.—In the epopee the poet assumes the character of calm inspiration; and therefore his language must be elevated, and his numbers majestic and uniform. A peasant speaking in heroic or hexameter verse is no improbability here; because his words are supposed to be transmitted by one who will of his own accord give them every ornament necessary to reduce them into dignified measure; as an eloquent man, in a solemn assembly, recapitulating the speech of a clown, would naturally express it in pure and perspicuous language. The uniform heroic measure will suit any subject of dignity, whether narrative or didactic, that admits or requires uniformity of style. In tragedy, where the imitation of real life is more perfect than in epic poetry, the uniform magnificence of epic numbers might be improper; because the heroes and heroines are supposed to speak in their own persons, and according to the immediate impulse of passion and sentiment. Yet, even in tragedy, the versification may be both harmonious and dignified; because the the characters are taken chiefly from high life, and the events from a remote period; and because the higher poetry is permitted to imitate nature, not as it is, but in that state of perfection in which it might be. The Greeks and Romans considered their hexameter as too artificial for dramatic poetry; and therefore in tragedy, and even in comedy, made use of the iambic, and some other measures that came near the cadence of conversation: we use the iambic both in the epic and dramatic poem; but for the most part it is, or ought to be, much more elaborate in the former than in the latter. In dramatic comedy, where the manners and concerns of familiar life are exhibited, verse would seem to be unnatural, except it be so like the course of common discourse as to be hardly distinguishable from it. Custom, however, may in some countries determine otherwise; and against custom, in these matters, it is vain to argue. The professed enthusiasm of the dithyrambic poet renders wildness, variety, and a sonorous harmony of numbers, peculiarly suitable to his odes. The love-sonnet, and Anacreontic song, will be less various, more regular, and of a softer harmony; because the state of mind expressed in it has more composure. Philosophy can scarce go farther in this investigation, without deviating into whim and hypothesis. The particular sorts of verse to be adopted in the lower species of poetry, are determined by fashion chiefly, and the practice of approved authors.

71
The language of the epic poet must be elevated and his numbers uniformly majestic.

72
In tragedy the same uniform magnificence would be improper, and much more so in comedy.

III. The origin and principles of *imitative harmony*, or of that artifice by which the sound is made, as Pope says, "an echo to the sense," may be explained in the following manner.

73
A striking analogy between moral and material beauty and deformity.

It is pleasing to observe the uniformity of nature in all her operations. Between moral and material beauty and harmony, between moral and material deformity and dissonance, there obtains a very striking analogy. The visible and audible expressions of almost every virtuous emotion are agreeable to the eye and the ear, and those of almost every criminal passion disagreeable. The looks, the attitudes, and the vocal sounds, natural to benevolence, to gratitude, to compassion, to piety, are in themselves graceful and pleasing; while anger, discontent, despair, and cruelty, bring discord to the voice, deformity to the features, and distortion to the limbs. That flowing curve, which painters know to be essential to the beauty of animal shape, gives place to a multiplicity of right lines and sharp angles in the countenance and gesture of him who knits his brows, stretches his nostrils, grinds his teeth, and clenches his fist; whereas, devotion, magnanimity, benevolence, contentment, and good-humour, soften the attitude, and give a more graceful swell to the outline of every feature. Certain vocal tones accompany certain mental emotions. The voice of sorrow is feeble and broken, that of despair boisterous and incoherent; joy assumes a sweet and sprightly note, fear a weak and tremulous cadence; the tones of love and benevolence are musical and uniform, those of rage loud and dissonant; the voice of the sedate reasoner is equable and grave, but not unpleasant; and he who declaims with energy, employs many varieties of modulation suited to the various emotions that predominate in his discourse.

But it is not in the language of passion only that the human voice varies its tone, or the human face its features. Every striking sentiment, and every interesting idea, has an effect upon it. One would esteem that person no adept in narrative eloquence, who should describe, with the very same accent, swift and slow emotion, extreme labour and easy performance, agreeable sensation and excruciating pain: who should talk of the tumult of a tempestuous ocean, the roar of thunder, the devastations of an earthquake, or an Egyptian pyramid tumbling into ruins, in the same tone of voice wherewith he describes the murmur of a rill, the warbling of the harp of Æolus, the swinging of a cradle, or the descent of an angel. Elevation of mind gives dignity to the voice. From Achilles, Sarpedon, and Othello, we should as naturally expect a manly and sonorous accent, as a nervous style and majestic attitude. Coxcombs and bullies, while they assume airs of importance and valour, affect also a dignified articulation.

74 The source of imitative harmony of numbers.

Since the tones of natural language are so various, poetry, which imitates the language of nature, must also vary its tones; and, in respect of sound as well as of meaning, be framed after that model of ideal perfection, which the variety and energy of the human articulate voice render probable. This is the more easily accomplished, because in every language there is between the sound and sense of certain words a perceptible analogy; which, though not so accurate as to lead a foreigner from the sound to the signification, is yet accurate enough to show, that, in forming such words, regard has been had to the imitative qualities of vocal sound. Such, in English, are the words *yell*, *crash*, *crack*, *hiss*, *roar*, *murmur*, and many others.

All the particular laws that regulate this sort of imitation, as far as they are founded in nature, and liable to the cognizance of philosophy, depend on the general law of style above mentioned. Together with the other circumstances of the supposed speaker, the poet takes into consideration the tone of voice suitable to the ideas that occupy his mind, and thereto adapts the sound of his language, if it can be done consistently with ease and elegance of expression. But when this imitative harmony is too much sought after, or words appear to be chosen for sound rather than sense, the verse becomes finical and ridiculous. Such is Ronsard's affected imitation of the song of the sky-lark:

> Elle quindée du zephire
> Sublime en l'air vire et revire,
> Et y declique un joli cris,
> Qui rit, guérit, et tire l'ire
> Des esprit mieux que je n'écris.

This is as ridiculous as that line of Ennius,

> Tum tuba terribili sonitu taratantara dixit:

Or as the following verses of Swift;

> The man with the kettle-drum enters the gate,
> Dub dub a dub dub: the trumpeters follow,
> Tantara tantara; while all the boys hollow.

75 What harmony of numbers can imitate.

Words by their sound may imitate sound; and quick or slow articulation may imitate quick or slow motion. Hence, by a proper choice and arrangement of words, the poet may imitate *Sounds* that are sweet with dignity (H),—sweet and tender (I),—loud (K),—and harsh (L),—and *Motions* that are slow, in consequence of dignity (M),—slow in consequence of difficulty (N), swift

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(H) No sooner had th' Almighty ceas'd, than all
The multitude of angels, with a shout
Loud as from numbers without number, sweet
As from blest voices uttering joy; heav'n rung
With jubilee, and loud hosannas fill'd
Th' eternal regions.—— *Par. Lost*, iii.

See also the night-storm of thunder, lightning, wind, and rain, in Virg. Georg. lib. i. ver. 328—334.

(I) Et longum, formose, vale, vale, inquit, Iola.
Virg. Ecl. i.

Formosam resonare doces Amaryllida silvas.
Virg. Ecl. i.

See also the simile of the nightingale, Georg. lib. iv. ver. 511. And see that wonderful couplet describing the wailings of the owl, Æneid iv. 462.

(K)————vibratus ab æthere fulgor
Cum sonitu venit, et ruere omnia visa repente,
Tyrrhenusque tubæ mugire per æthera clangor,
Suspiciunt: iterum atque iterum fragor increpat
ingens. *Æneid*, viii.

See also the storm in the first book of the Æneid, and in the first of the Odyssey.

(L) The hoarse rough verse should like the torrent
roar. *Pope*.

————On a sudden open fly,
With impetuous recoil and jarring sound,
Th' infernal doors, and on their hinges grate
Harsh thunder.—— *Par. Lost*, ii. 879.

See also Homer's Iliad, lib. ii. ver. 363, and Clarke's Annotation.

(M) See an exquisite example in Gray's Progress of Poesy; the conclusion of the third stanza.

(N) And when up ten steep slopes you've dragg'd
your thighs. *Pope*.

Just brought out this, when scarce his tongue could
stir. *Pope*.

————The huge leviathan
Wallowing unwieldy, enormous in their gait,
Tempest the ocean. *Par. Lost*, vii. 411.

Of Poetical Harmony.

swift and noisy (O)—swift and smooth (P)—uneven and abrupt (Q),—quick and joyous (R). An unexpected pause in the verse may also imitate a sudden failure of strength (S), or interruption of motion (T), or give vivacity to an image or thought, by fixing our attention longer than usual upon the word that precedes it (U).—Moreover, when we describe great bulk, it is natural for us to articulate slowly, even in common discourse; and therefore a line of poetry that requires a slow pronunciation, or seems longer than it should be, may be used with good effect in describing vastness of size (X).—Sweet and smooth numbers are most proper, when the poet paints agreeable objects, or gentle energy (Y); and harsher sounds when he speaks of what is ugly, violent, or disagreeable (Z). This too is according to the nature of common language; for we generally employ harsher tones of voice to express what we dislike, and more melodious notes to describe the objects of love, complacency, and admiration. Harsh numbers, however, should not be frequent in poetry: for in this art, as in music, concord and melody ought always to predominate. And we find in fact, that good poets can occasionally express themselves somewhat harshly, when the subject requires it, and yet preserve the sweetness and majesty of poetical diction. Further, the voice of complaint, pity, love, and all the gentler affections is mild and musical, and should therefore, be imitated in musical numbers; while despair, defiance, revenge, and turbulent emotions in general, assume an abrupt and sonorous cadence. Dignity of description (A), solemn vows (B), and all sentiments that proceed from a mind elevated with great ideas (C), require a correspondent

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See the famous description of Sisyphus rolling the stone, Odyss. lib. xi. ver. 592. See Quintil. Inst. Orat. lib. ix. cap. 4. § 4. compared with Paradise Lost, book ii. ver. 1022.

(O) Quadrupedante putrem sonitu quatit ungula
campum. *Æneid.*

Αυταρ επειτα πεδονδε κυλινδετο λαας αναιδης. *Odyss.* xi.

See also Virg. Æneid. lib. i. ver. 83—87.

(P) See wild as the winds o'er the desert he flies.
Pope.

Ille volat, simul arva fuga, simul æquora verrens.
Virg.

Ρηιδιη τ' επειτα πελει, χαλεπη περ εουσα. *Hesiod.*

(Q) Πολλα δ' αναντα καταντα παραντα τε δοχμια τ' ηλθον.
Hom.

The lass shriek'd, started up, and shriek'd again.
Anonym.

(R) Let the merry bells ring round,
And the jocund rebecks sound,
To many a youth, and many a maid,
Dancing in the chequer'd shade. *Milt. Allegro.*

See also Gray's Progress of Poesy, stanza 3.

(S) Ac velut in somnis oculos ubi languida pressit
Nocte quies, nequicquam avidos extendere cursus
Velle videmur:—et in mediis conatibus ægri
Succidimus.— *Æneid.*

See also Virg. Georg. lib. iii. ver. 515, 516.

(T) For this, be sure to-night thou shalt have cramps
Side-stitches that shall pen thy breath up. Urchins
Shall exercise upon thee.——
Prospero to Calyban in *the Tempest.*

See Pope's Iliad, xiii. 109.

(U) ———How often from the steep
Of echoing hill or thicket have we heard
Celestial voices, to the midnight air,
Sole,—or responsive to each other's note,
Singing their great Creator?——*Par. Lost*, iv.

And over them triumphant Death his dart
Shook,——but delay'd to strike. *Id.*

See also Hom. Odyss. lib. ix. ver. 290.

(X) Thus stretch'd out, huge in length, the arch fiend
lay. *Par. Lost.*

Monstrum horrendum, informe, ingens, cui lumen
ademptum. *Æneid.* iii.

Et magnos membrorum artus, magna ossa, lacertosque
Exuit, atque ingens media consistit arena.
Æneid. v. 422.

(Y) Hic gelidi fontes, hic mollia prata, Lycori,
Hic nemus, hic ipso tecum consumerer ævo.
Virg, Ecl. x.

The dumb shall sing; the lame his crutch forego,
And leap, exulting, like the bounding roe.
Pope's Messiah.

See Milton's description of the evening, Par. Lost, book iv. ver. 598—609.

Ye gentle gales beneath my body blow,
And softly lay me on the waves below.
Pope's Sappho.

(Z) Stridenti stipula miserum disperdere carmen.
Virg. Ecl. iii.

Immo ego Sardois videar tibi amarior herbis,
Horridior rusco, projecta vilior alga.
Virg. Ecl. vii.

Neu patriæ validas in viscera vertite vires.
Virg. Æneid. vi.

See also Milton's description of the Lazar-house in Paradise Lost, book xi. ver. 477—492.

(A) See Virg. Georg. l. 328. and Homer, Virgil, and Milton, *passim.* See also Dryden's Alexander's Feast, and Gray's Odes.

(B) See Virg. Æneid, iv. 24.

(C) Examples are frequent in the great authors. See Othello's exclamation:

————O now for ever
Farewell the tranquil mind! &c. *Act* iii. *sc.* 3.

correspondent pomp of language and versification.—Lastly, an irregular or uncommon movement in the verse may sometimes be of use, to make the reader conceive an image in a particular manner. Virgil, describing horses running over rocky heights at full speed, begins the line with two dactyls, to imitate rapidity, and concludes it with eight long syllables:

> Saxa per, et scopulos, et depressas convalles,
> *Georg.* iii. 276.

which is very unusual measure, but seems well adapted to the thing expressed, namely, to the descent of the animal from the hills to the low ground. At any rate, this extraordinary change of the rhythm may be allowed to bear some resemblance to the animal's change of motion, as it would be felt by a rider, and as we may suppose it is felt by the animal itself.

Other forms of imitative harmony, and many other examples, besides those referred to in the margin, will readily occur to all who are conversant in the writings of the best versifiers, particularly Homer, Virgil, Milton, Lucretius, Spenser, Dryden, Shakespeare, Pope, and Gray.

PART II. OF THE DIFFERENT SPECIES OF POETRY, with their PARTICULAR PRINCIPLES.

SECT. I. *Of Epic and Dramatic Compositions.*

§ 1. *The Epopee and Drama compared.*

Elem. of Criticism.

76
In what tragic and epic poetry agree, and in what they differ.

TRAGEDY and the epic differ not in substantials: in both the same ends are proposed, viz. instruction and amusement; and in both the same mean is employed, viz. imitation of human actions. They differ only in the manner of imitating; epic poetry employs narration; tragedy represents its facts as passing in our sight: in the former, the poet introduces himself as an historian; in the latter, he presents his actors, and never himself.

This difference, regarding form only, may be thought slight: but the effects it occasions are by no means so; for what we see makes a deeper impression than what we learn from others. A narrative poem is a story told by another: facts and incidents passing upon the stage, come under our own observation; and are beside much enlivened by action and gesture, expressive of many sentiments beyond the reach of language.

A dramatic composition has another property, independent altogether of action; which is, that it makes a deeper impression than narration: in the former, persons express their own sentiments; in the latter, sentiments are related at second-hand. For that reason, Aristotle, the father of critics, lays it down as a rule *, That in an epic poem the author ought to have every opportunity of introducing his actors, and of confining the narrative part within the narrowest bounds. Homer understood perfectly the advantage of this method; and his poems are both of them in a great measure dramatic. Lucan runs to the opposite extreme; and is guilty of a still greater fault, in stuffing his *Pharsalia* with cold and languid reflections, the merit of which he assumes to himself, and deigns not to share with his actors. Nothing can be more injudiciously timed, than a chain of such reflections, which suspend the battle of Pharsalia, after the leaders had made their speeches, and the two armies are ready to engage †.

77
ragic and pic poetry athetic or oral.

Aristotle, from the nature of the fable, divides tragedy into simple and complex: but it is of greater moment, with respect to dramatic as well as epic poetry, to found a distinction upon the different ends attained by such compositions. A poem, whether dramatic or epic, that has nothing in view but to move the passions and to exhibit pictures of virtue and vice, may be distinguished by the name of *pathetic*: but where a story is purposely contrived to illustrate some moral truth, by showing that disorderly passions naturally lead to external misfortunes, such compositions may be denominated *moral*. Beside making a deeper impression than can be done by cool reasoning, a moral poem does not fall short of reasoning in affording conviction: the natural connection of vice with misery, and of virtue with happiness, may be illustrated by stating a fact as well as by urging an argument. Let us assume, for example, the following moral truths: That discord among the chiefs renders ineffectual all common measures; and that the consequences of a slightly founded quarrel, fostered by pride and arrogance, are not less fatal than those of the grossest injury: these truths may be inculcated by the quarrel between Agamemnon and Achilles at the siege of Troy. If facts or circumstances be wanting, such as tend to rouse the turbulent passions, they must be invented; but no accidental nor unaccountable event ought to be admitted; for the necessary or probable connection between vice and misery is not learned from any events but what are naturally occasioned by the characters and passions of the persons represented, acting in such circumstances. A real event, of which we see not the cause, may afford a lesson, upon the presumption that what hath happened may again happen: but this cannot be inferred from a story that is known to be a fiction.

78
The good effects of such compositions.

Many are the good effects of such compositions. A pathetic composition, whether epic or dramatic, tends to a habit of virtue, by exciting us to do what is right, and restraining us from what is wrong. Its frequent pictures of human woes, produce, beside, two effects, extremely salutary: They improve our sympathy, and fortify us to bear our misfortunes. A moral composition must obviously produce the same good effects, because by being moral it ceaseth not to be pathetic: it enjoys besides an excellence peculiar to itself; for it not only improves the heart, as above mentioned, but instructs the head by the moral it contains. It seems impossible to imagine any entertainment more suited to a rational being, than a work thus happily illustrating some moral truth; where a number of persons of different characters are engaged in an important action, some retarding, others promoting, the great catastrophe; and where there is dignity of style as well as of matter. A work of this kind has our sympathy at command;

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* *Poet.* chap 25. sect. 6.

† *Lib* vii. rom line 85 to line 60.

mand, and can put in motion the whole train of the social affections: our curiosity in some scenes is excited, in others gratified; and our delight is consummated at the close, upon finding, from the characters and situations exhibited at the commencement, that every incident down to the final catastrophe is natural, and that the whole in conjunction make a regular chain of causes and effects.

79
The same subjects not always fit for tragic and epic poetry.

Considering that an epic and a dramatic poem are the same in substance, and have the same aim or end, one will readily imagine, that subjects proper for the one must be equally proper for the other. But considering their difference as to form, there will be found reason to correct that conjecture, at least in some degree. Many subjects may indeed be treated with equal advantage in either form: but the subjects are still more numerous for which they are not equally qualified; and there are subjects proper for the one and not at all for the other. To give some slight notion of the difference, as there is no room here for enlarging upon every article, we observe, that dialogue is better qualified for expressing sentiments, and narrative for displaying facts. Heroism, magnanimity, undaunted courage, and other elevated virtues, figure best in action: tender passions, and the whole tribe of sympathetic affections, figure best in sentiment. It clearly follows, that tender passions are more peculiarly the province of tragedy, grand and heroic actions of epic poetry.

"The epic poem is universally allowed to be *, of all poetical works, the most dignified, and, at the same time, the most difficult in execution. To contrive a story which shall please and interest all readers, by being at once entertaining, important, and instructive; to fill it with suitable incidents; to enliven it with a variety of characters and of descriptions; and, throughout a long work, to maintain that propriety of sentiment, and that elevation of style, which the epic character requires, is unquestionably the highest effort of poetical genius.

80
The proper subject of an epic poem.

"The action or subject of the epic poem must be great and interesting. Without greatness it would not have sufficient importance either to fix our attention or to justify the magnificent apparatus which the poet bestows on it. This is so evidently requisite as not to require illustration; and, indeed, hardly any who have attempted epic poetry have failed in choosing some subject sufficiently important, either by the nature of the action or by the fame of the personages concerned in it. The fame of Homer's heroes, and the consequences of dissension between the greatest of them, is a subject important in itself, and must have appeared particularly so to his countrymen, who boasted their descent from those heroes. The subject of the Æneid is still greater than that of the Iliad, as it is the foundation of the most powerful empire that ever was established upon this globe; an event of much greater importance than the destruction of a city, or the anger of a semibarbarous warrior. But the poems of Homer and Virgil fall in this respect infinitely short of that of Milton. 'Before the greatness displayed in Paradise Lost, it has been well observed † that all other greatness shrinks away. The subject of the English poet is not the destruction of a city, the conduct of a colony, or the foundation of an empire: it is the fate of worlds, the revolutions of heaven and earth; rebellion against the Supreme King, raised by the highest order of created beings; the overthrow of their host and the punishment of their crime; the creation of a new race of reasonable creatures; their original happiness and innocence, their forfeiture of immortality, and their restoration to hope and peace."

An epic poem, however, is defective if its action be not interesting as well as great; for a narrative of mere valour may be so constructed as to prove cold and tiresome. "Much * will depend on the happy choice of some subject, which shall by its nature interest the public; as when the poet selects for his hero one who is the founder, or the deliverer, or the favourite of his nation; or when he writes achievements that have been highly celebrated, or have been connected with important consequences to any public causee. Most of the great epic poems are abundantly fortunate in this respect, and must have been very interesting to those ages in which they were composed." The subject of the Paradise Lost, as it is infinitely greater, must likewise be considered as more universally interesting than that of any other poem. "We all feel the effects of Adam's transgression; we all sin like him, and like him must all bewail our offences. We have restless and insidious enemies in the fallen angels, and in the blessed spirits we have guardians and friends; in the redemption of mankind we hope to be included; in the description of heaven and hell we are surely interested, as we are all to reside hereafter either in the regions of horror or bliss."

81
Circumstances chiefly interesting in epic poetry.

"The chief circumstance which renders an epic poem interesting †, and which tends to interest not one age or country alone, but all readers, is the skilful conduct of the author in the management of his subject. His plan must comprehend many affecting incidents. He may sometimes be awful and august; he must often be tender and pathetic; he must give us gentle and pleasing scenes of love, friendship, and affection. The more that an epic poem abounds with situations which awaken the feelings of humanity, it is the more interesting. In this respect perhaps no epic poets have been so happy as Virgil and Tasso. The plan of the *Paradise Lost* comprises neither human actions nor human manners. The man and woman who act and suffer, are in a state which no other man or woman can ever know. The reader finds no transaction in which he can be engaged; beholds no condition in which he can by any effort of imagination place himself; he has therefore little natural curiosity or sympathy."

82
Whether the hero must necessarily be successful.

A question has been moved, Whether the nature of the epic poem does not require that the hero should be ultimately successful? To this question Johnson replies, that "there is no reason why the hero should not be unfortunate, except established practice, since success and virtue do not necessarily go together." Most critics, however, are of a different opinion, and hold success to be, if not the necessary, at least the most proper issue of an epic poem. An unhappy conclusion depresses the mind, and is opposite to the elevating emotions which belong to this species of poetry. Terror and compassion are the proper subjects of tragedy; but as the epic is of larger extent, it were too much, if, after the difficulties and troubles which commonly abound in the progress of the poem, the author should bring them all at last to an unfortunate conclusion. We know not that any author of name has held this course except *Lucan*; for in the *Paradise Lost*, as Adam's deceiver is at last crushed, and he himself restored to the favour of his maker, Milton's hero must be considered as finally successful.

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* *Blair's Lectures.*

† *Johnson's Life of Milton.*

* *Blair ubi supra.*

† *Blair and Johnson.*

We have no occasion to say more of the epic, considered as peculiarly adapted to certain subjects, and to be conducted according to a certain plan. But as dramatic subjects are more complex, it is necessary to take a narrower view of them. They are either the light and the gay, or the grave and affecting, incidents of human life. The former constitute the subject of comedy, and the latter of tragedy.

As great and serious objects command more attention than little and ludicrous ones; as the fall of a hero interests the public more than the marriage of a private person; tragedy has been always held a more dignified entertainment than comedy. The first thing required of the tragic poet is, that he pitch upon some moving and interesting story, and that he conduct it in a natural and probable manner. For we must observe, that the natural and probable are more essential to tragic than even to epic poetry. Admiration is excited by the wonderful; but passion can be raised only by the impressions of nature and truth upon the mind.

84 Subjects best suited to tragedy.

The subject best fitted for tragedy is where a man has himself been the cause of his misfortune; not so as to be deeply guilty, nor altogether innocent: the misfortune must be occasioned by a fault incident to human nature, and therefore in some degree venial. Such misfortunes call forth the social affections, and warmly interest the spectator. An accidental misfortune, if not extremely singular, doth not greatly move our pity: the person who suffers, being innocent, is freed from the greatest of all torments, that anguish of mind which is occasioned by remorse. An atrocious criminal, on the other hand, who brings misfortunes upon himself, excites little pity, for a different reason: his remorse, it is true, aggravates his distress and swells the first emotions of pity: but then our hatred of him as a criminal blending with pity, blunts its edge considerably. Misfortunes that are not innocent nor highly criminal, partake the advantages of each extreme: they are attended with remorse to embitter the distress, which raises our pity to a great height; and the slight indignation we have at a venial fault detracts not sensibly from our pity. The happiest of all subjects accordingly for raising pity, is where a man of integrity falls into a great misfortune by doing an action that is innocent, but which, by some singular means, is conceived by him to be criminal: his remorse aggravates his distress; and our compassion, unrestrained by indignation, knows no bounds. Pity comes thus to be the ruling passion of a pathetic tragedy; and, by proper representation, may be raised to a height scarcely exceeded by any thing felt in real life. A moral tragedy takes in a larger field; as it not only exercises our pity, but raises another passion, which, though selfish, deserves to be cherished equally with the social affection. The passion we have in view is fear or terror; for when a misfortune is the natural consequence of some wrong bias in the temper, every spectator who is conscious of such a bias in himself takes the alarm, and dreads his falling into the same misfortune: and by the emotion of fear or terror, frequently reiterated in a variety of moral tragedies, the spectators are put upon their guard against the disorders of passion.

The commentators upon Aristotle, and other critics, have been much gravelled about the account given of tragedy by that author: "That by means of pity and terror, it refines or purifies in us all sorts of passion." But no one who has a clear conception of the end and effects of a good tragedy, can have any difficulty about Aristotle's meaning: Our pity is engaged for the persons represented; and our terror is upon our own account. Pity indeed is here made to stand for all the sympathetic emotions, because of these it is the capital. There can be no doubt, that our sympathetic emotions are refined or improved by daily exercise; and in what manner our other passions are refined by terror, has been just now said. One thing is certain, that no other meaning can justly be given to the foregoing doctrine than that now mentioned; and that it was really Aristotle's meaning, appears from his 13th chapter, where he delivers several propositions conformable to the doctrines as here explained. These, at the same time, we take liberty to mention; because, so far as authority can go, they confirm the foregoing reasoning about subjects proper for tragedy. The first proposition is, That it being the province of tragedy to excite pity and terror, an innocent person falling into adversity ought never to be the subject. This proposition is a necessary consequence of his doctrine as explained; a subject of that nature may indeed excite pity and terror; but the former in an inferior degree, and the latter in no degree for moral instruction. The second proposition is, That the history of a wicked person in a change from misery to happiness ought not to be represented; which excites neither terror nor compassion, nor is agreeable in any respect. The third is, That the misfortunes of a wicked person ought not to be represented: such representation may be agreeable in some measure upon a principle of justice; but it will not move our pity, or any degree of terror, except in those of the same vicious disposition with the person represented. The last proposition is, that the only character fit for representation lies in the middle, neither eminently good nor eminently bad; where the misfortune is not the effect of deliberate vice, but of some involuntary fault, as our author expresses it. The only objection we find to Aristotle's account of tragedy, is, that he confines it within too narrow bounds, by refusing admittance to the pathetic kind: for if terror be essential to tragedy, no representation deserves that name but the moral kind, where the misfortunes exhibited are caused by a wrong balance of mind, or some disorder in the internal constitution: such misfortunes always suggest moral instruction: and by such misfortunes only can terror be excited for our improvement.

Thus Aristotle's four propositions above mentioned relate solely to tragedies of the moral kind. Those of the pathetic kind are not confined within so narrow limits: subjects fitted for the theatre are not in such plenty as to make us reject innocent misfortunes which rouse our sympathy, though they inculcate no moral. With respect indeed to the subjects of that kind, it may be doubted, whether the conclusion ought not always to be fortunate. Where a person of integrity is represented as suffering to the end under misfortunes purely accidental, we depart discontented, and with some obscure sense of injustice: for seldom is man so submissive to Providence, as not to revolt against the tyranny and vexations of blind chance; he will be tempted to say, this ought not to be. We give for an example the *Romeo and Juliet* of Shakespeare, where the fatal catastrophe is occasioned by Friar Lawrence's coming to the monument a minute too late; we are vexed at the unlucky chance, and go away dissatisfied. Such impressions, which ought not to be cherished, are a sufficient reason for excluding stories of this kind from the theatre.

85 The improper use of destiny in the ancient tragedies.

The misfortunes of a virtuous person, arising from necessary causes, or a chain of unavoidable circumstances, as they excite a notion of destiny, are equally unsatisfactory to the human mind. A metaphysician in his closet may reason himself into the belief of fate, or what in modern language is called *philosophical necessity;* but the feelings of the heart revolt against that doctrine; and we have the confession of the two ablest philosophers by whom it was ever maintained, that men conduct themselves through life as if their will were absolutely free, and their actions no part of a chain of necessary causes and effects. As no man goes to the theatre to study metaphysics, or to divest himself of the common feelings of humanity, it is impossible, whatever be his philosophical creed, that he should contemplate without horror and disgust an innocent person suffering by mere destiny. A tragedy of uncommon merit in every other respect may indeed be endured, nay perhaps admired, though such be its catastrophe; because no work of man was ever perfect; and because, where imperfections are unavoidable, a multitude of excellencies may be allowed to cover one fault: but we believe the misery of an innocent person resulting from a chain of unavoidable circumstances has never been considered as a beauty by minds unperverted by a false philosophy. "It must be acknowledged * that the subjects of the ancient Greek tragedies were frequently founded on mere destiny and inevitable misfortunes. In the course of the drama many moral sentiments occurred; but the only instruction which the fable conveyed was, that reverence was due to the gods, and submission to the decrees of fate. Modern tragedy has aimed at a higher object, by becoming more the theatre of passion; pointing out to men the consequences of their own misconduct, showing the direful effects which ambition, jealousy, love, resentment, and other such strong emotions, when misguided or left unrestrained, produce upon human life. An Othello, hurried by jealousy to murder his innocent wife; a Jaffier ensnared by resentment and want to engage in a conspiracy, and then stung with remorse and involved in ruin; a Siffredi, through the deceit which he employs for public-spirited ends, bringing destruction an all whom he loved: these, and such as these, are the examples which Tragedy now displays to public view; and by means of which it inculcates on men the proper government of their passions."

86 How it is used in the tragedy of the Robbers.

There is indeed one singular drama, in which destiny is employed in a manner very different from that in which it was used by the poets of Greece and Rome. It is Schiller's tragedy of the Robbers, of which "the hero, endowed by nature (as the translator of the piece observes) with the most generous feelings, animated by the highest sense of honour, and susceptible of the warmest affections of the heart, is driven by the perfidy of a brother, and the supposed inhumanity of his father, into a state of confirmed misanthropy and despair." He wished that he "could blow the trumpet of rebellion through all nature; that he could extinguish with one mortal blow the viperous race of men; and that he could so strike as to destroy the germ of existence." In this situation he is hurried on to the perpetration of a series of crimes which find from their very magnitude and atrocity a recommendation to his distempered mind. Sensible all the while of his own guilt, and suffering for that guilt the severest pangs of remorse, he yet believes himself an instrument of vengeance in the hands of the Almighty for the punishment of the crimes of others. In thus accomplishing the dreadful destiny which is prescribed for him, he feels a species of gloomy satisfaction, at the same time that he considers himself as doomed to the performance of that part in life which is to consign his memory to infamy and his soul to perdition. After burning a town, he exclaims, "O God of vengeance! am I to blame for this? Art thou to blame, O Father of Heaven! when the instruments of thy wrath, the pestilence, flood, and famine overwhelm at once the righteous and the guilty? Who can command the flames to stay their course, to destroy only the noxious vermin, and spare the fertile field?" yet with the same breath he accuses himself of extreme criminality for "presumptuously wielding the sword of the Most High!" He frequently laments in the most affecting manner the loss of his innocence, wishes that "he could return into the womb that bare him, that he hung an infant at the breast, that he were born a beggar, the meanest hind, a peasant of the field." He considers himself as the outcast of Heaven, and finally rejected by the Father of mercy; yet he tells the band of robbers whom he commanded, that the "Almighty honoured them as agents in his hands to execute his wonderous purposes; employed them as his angels to execute his stern decrees, and pour the vials of his wrath;" and in a very solemn prayer, he supposes "that the God who ruleth over all had *decreed* that he should become the chief of these foul murderers."

"It will be allowed (says the translator), that the imagination could not have conceived a spectacle more deeply interesting, more powerfully affecting to the mind of man, than that of a human being thus characterised and acting under such impressions. The compassionate interest which the mind feels in the emotions or sufferings of the guilty person, is not diminished by the observation, that he acts under an impression of inevitable destiny; on the contrary, there is something in our nature which leads us the more to compassionate the instrument of those crimes, that we see him consider himself as bound to guilt by fetters, which he has the constant wish, but not the strength, to break."

This is indeed true: we sympathise with the hero of the Robbers, not only on account of his exalted sentiments and his inflexible regard to the abstract principles of honour and justice, but much more for that disorder of intellect which makes him *suppose* "his destiny fixed and unalterable," at the very time that he is torn with remorse for the perpetration of those crimes by which he believed it to be fulfilling. Destiny, however, is not in this tragedy exhibited as real, but merely as the phantom of a distempered though noble mind. Had the poet represented his hero as in *fact decreed by God*, or *bound by fate*, to head a band of foul murderers, and to commit a series of the most atrocious crimes; though our pity for him might not have been lessened, the impressions of the whole piece on the mind could have been only those of horror and disgust at what would have appeared to us the unequal ways of providence.

The tragedy of the Robbers is a striking instance of the justness of Dr Blair's criticism, in opposition to that of

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* *Blair.*

87
Whether the subject of tragedy should have its foundation in truth.

of Lord Kames. His lordship holds that it is essential to a good tragedy, that its principal facts be borrowed from history; because a mixture of known truth with the fable tends to delude us into a conviction of the reality of the whole. The Doctor considers this as a matter of no great consequence; for "it is proved by experience, that a fictitious tale, if properly conducted, will melt the heart as much as any real history;" this observation is verified in the Robbers. It is indeed a very irregular drama, and perhaps could not be acted on a British theatre. But although the whole is known to be a fiction, we believe there are few effusions of human genius which more powerfully excite the emotions of terror and pity. Truth is indeed congenial to the mind; and when a subject proper for tragedy occurs in history or tradition, it is perhaps better to adopt it than to invent one which has no such foundation. But in choosing a subject which makes a figure in history, greater precaution is necessary than where the whole is a fiction. In the latter case the author is under no restraint other than that the characters and incidents be just copies of nature. But where the story is founded on truth, no circumstances must be added, but such as connect naturally with what are known to be true; history may be supplied, but must not be contradicted. Further, the subject chosen must be distant in time, or at least in place; for the familiarity of recent persons and events ought to be avoided. Familiarity ought more especially to be avoided in an epic poem, the peculiar character of which is dignity and elevation: modern manners make but a poor figure in such a poem. Their familiarity unqualifies them for a lofty subject. The dignity of them will be better understood in future ages, when they are no longer familiar.

After Voltaire, no writer, it is probable, will think of rearing an epic poem upon a recent event in the history of his own country. But an event of that kind is perhaps not altogether unqualified for tragedy: it was admitted in Greece; and Shakespeare has employed it successfully in several of his pieces. One advantage it possesses above fiction, that of more readily engaging our belief, which tends above any other particular to raise our sympathy. The scene of comedy is generally laid at home: familiarity is no objection; and we are peculiarly sensible of the ridicule of our own manners.

88
How a tragedy should be divided into acts; and how many acts it should have.

Elem. of Criticism, ch. xxii.

After a proper subject is chosen, the dividing it into parts requires some art. The conclusion of a book in an epic poem, or of an act in a play, cannot be altogether arbitrary; nor be intended for so slight a purpose as to make the parts of equal length. The supposed pause at the end of every book, and the real pause at the end of every act, ought always to coincide with some pause in the action. In this respect, a dramatic or epic poem ought to resemble a sentence or period in language, divided into members that are distinguished from each other by proper pauses; or it ought to resemble a piece of music, having a full close at the end, preceded by imperfect closes that contribute to the melody. The division of every play into *five* acts has no other foundation than common practice, and the authority of Horace (D). It is a division purely arbitrary; there is nothing in the nature of the composition which fixes this number rather than any other; and it had been much better if no such number had been ascertained. But, since it is ascertained, every act in a dramatic poem ought to close with some incident that makes a pause in the action; for otherwise there can be no pretext for interrupting the representation. It would be absurd to break off in the very heat of action; against which every one would exclaim: the absurdity still remains where the action relents, if it be not actually suspended for some time. This rule is also applicable to an epic poem: though in it a deviation from the rule is less remarkable; because it is in the reader's power to hide the absurdity, by proceeding instantly to another book. The first book of Paradise Lost ends without any close, perfect or imperfect: it breaks off abruptly, where Satan, seated on his throne, is prepared to harangue the convocated host of the fallen angels; and the second book begins with the speech. Milton seems to have copied the Æneid, of which the two first books are divided much in the same manner. Neither is there any proper pause at the end of the seventh book of Paradise Lost, nor at the end of the eleventh. In the Iliad little attention is given to this rule.

89
The object of comedy.

Besides tragedy, dramatic poetry comprehends comedy and farce. These are sufficiently distinguished from tragedy by their general spirit and strain. "While pity and terror, and the other strong passions, form the province of the tragic muse, the chief or rather sole instrument of comedy and farce is ridicule." These two species of composition are so perpetually running into each other, that we shall not treat of them separately; since what is now known by the name of *farce* differs in nothing essential from what was called the *old comedy* among the Greeks. "Comedy proposes for its object* neither the great sufferings nor the great crimes of men; but their follies and slighter vices, those parts of their character which raise in beholders a sense of impropriety, which expose them to be censured and laughed at by others, or which render them troublesome in civil society.

* *Blair's Lectures.*

"The subjects of tragedy are not limited to any age or country; but the scene and subject of comedy should always be laid in our own country, and in our own times. The reason is obvious: those decorums of behaviour, those lesser discriminations of character, which afford subject for comedy, change with the differences of countries and times; and can never be so well understood by foreigners as by natives. The comic poet, who aims at correcting improprieties and follies of behaviour, should 'catch the manners living as they rise.' It is not his business to amuse us with a tale of other times; but to give us pictures taken from among ourselves; to satirize

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(D) *Neve minor, neu sit quinto productior actu*
Fabula. De Arte Poetica.

If you would have your play deserve success,
Give it five acts complete, nor more nor less. Francis.

reigning and present vices; to exhibit to the age a faithful copy of itself, with its humours, its follies, and its extravagancies.

90 Comedy of two kinds.

"Comedy may be divided into two kinds: comedy of *character*, and comedy of *intrigue*. The former is the more valuable species; because it is the business of comedy to exhibit the prevailing manners which mark the character of the age in which the scene is laid: yet there should be always as much intrigue as to give us something to wish and something to fear. The incidents should so succeed one another, as to produce striking situations, and to fix our attention; while they afford at the same time a proper field for the exhibition of character. The action in comedy, though it demands the poet's care in order to render it animated and natural, is a less significant and important part of the performance than the action in tragedy: as in comedy it is what men say, and how they behave, that draws our attention, rather than what they perform or what they suffer.

91 The common faults of comedy.

"In the management of characters, one of the most common faults of comic writers is the carrying of them too far beyond life. Wherever ridicule is concerned, it is indeed extremely difficult to hit the precise point where true wit ends and buffoonery begins. When the miser in Plautus, searching the person whom he suspects of having stolen his casket, after examining first his right hand and then his left, cries out, *ostende etiam tertiam*—'show me your third hand,' there is no one but must be sensible of the extravagance. Certain degrees of exaggeration are allowed to the comedian, but there are limits set to it by nature and good taste; and supposing the miser to be ever so much engrossed by his jealousy and his suspicions, it is impossible to conceive any man in his wits suspecting another of having more than two hands."

It appears from the plays of Aristophanes which remain, that the characters in the old comedy of Athens were almost always overcharged. They were likewise direct and avowed satires against particular persons, who were brought upon the stage by name. "The ridicule employed in them is extravagant, the wit for the most part buffoonish and farcical, the raillery biting and cruel, and the obscenity that reigns in them is gross and intolerable. They seem to have been composed merely for the mob." Yet of these abominable dramas, an excellent critic* has affirmed, with too much truth, that what is now called *farce* is nothing more than the shadow. The characters in genuine comedy are not those of particular and known persons, but the general characters of the age and nation; which it requires no small skill to distinguish clearly and naturally from each other. In attempting this, poets are too apt to contrast characters and introduce them always in pairs; which gives an affected air to the whole piece. The perfection of art is to conceal art. "A masterly writer will give us his characters distinguished rather by such shades of diversity as are commonly found in society, than marked with such strong oppositions as are rarely brought into actual contrast in any of the circumstances of real life."

* *Hurd.*

92 The style of comedy.

The style of comedy ought to be pure, elegant, and lively, very seldom rising higher than the ordinary tone of polite conversation; and upon no occasion descending into vulgar, mean, and gross expressions; and in one word, action and character being the fundamental parts of every epic and dramatic composition, the sentiments and tone of language ought to be subservient to these, so as to appear natural and proper for the occasion.

§ 2. *Respective peculiarities of the Epopee and Drama.*

93 Machinery can have no place in a drama, nor

In a theatrical entertainment, which employs both the eye and the ear, it would be a gross absurdity to introduce upon the stage superior beings in a visible shape. There is no place for such objection in an *epic poem*; and Boileau, with many other critics, declares strongly for that sort of machinery in an epic poem. But waving authority, which is apt to impose upon the judgement, let us draw what light we can from reason. We may in the first place observe, that this matter is but indistinctly handled by critics: the poetical privilege of animating insensible objects for enlivening a description, is very different from what is termed *machinery*, where deities, angels, devils, or other supernatural powers, are introduced as real personages, mixing in the action, and contributing to the catastrophe; and yet these two things are constantly jumbled together in reasoning. The former is founded on a natural principle: but nothing is more unnatural than the latter. Its effects, at the same time, are deplorable. First, it gives an air of fiction to the whole; and prevents that impression of reality which is requisite to interest our affections, and to move our passions; which of itself is sufficient to explode machinery, whatever entertainment it may afford to readers of a fantastic taste or irregular imagination.

94 has it a good effect in the higher epic.

And next, were it possible, by disguising the fiction, to delude us into a notion of reality, an insuperable objection would still remain, which is, that the aim or end of an epic poem can never be attained in any perfection where machinery is introduced; for an evident reason, that virtuous emotions cannot be raised successfully but by the actions of those who are endued with passions and affections like our own, that is, by human actions; and as for moral instruction, it is clear, that none can be drawn from beings who act not upon the same principles with us. A fable in Æsop's manner is no objection to this reasoning: his lions, bulls, and goats, are truly men under disguise; they act and feel in every respect as human beings; and the moral we draw is founded on that supposition. Homer, it is true, introduces the gods into his fable: but the religion of his country authorized that liberty; it being an article in the Grecian creed, that the gods often interpose visibly and bodily in human affairs. It must however be observed, that Homer's deities do no honour to his poems: fictions that transgress the bounds of nature, seldom have a good effect; they may inflame the imagination for a moment, but will not be relished by any person of a correct taste. They may be of some use to the lower rank of writers; but an author of genius has much finer materials, of Nature's production, for elevating his subject, and making it interesting.

One would be apt to think, that Boileau, declaring for the Heathen deities, intended them only for embellishing the diction: but unluckily he banishes angels and devils, who undoubtedly make a figure in poetic language, equal to the Heathen deities. Boileau, therefore, by pleading for the latter in opposition to the former, certainly meant, if he had any distinct meaning that the Heathen deities may be introduced as actors. And, in fact, he himself is guilty of that glaring absurdity, where it is not so pardonable as in an epic poem: In his ode upon the taking of Namur, he demands with a most serious countenance, whether the walls were built by Apollo or Neptune: and in relating the passage of the Rhine, anno 1672, he describes the god of that river as fighting with all his might to oppose the French monarch; which is confounding fiction with reality at a strange rate. The French writers in general run into this error: wonderful the effect of custom entirely to hide from them how ridiculous such fictions are!

That this is a capital error in *Gierusalemme Liberata*, Tasso's greatest admirers must acknowledge: a situation can never be intricate, nor the reader even in pain about the catastrophe, so long as there is an angel, devil, or magician, to lend a helping hand. Voltaire, in his essay upon epic poetry, talking of the *Pharsalia*, observes judiciously, "That the proximity of time, the notoriety of events, the character of the age, enlightened and political, joined with the solidity of Lucan's subject, deprived him of poetical fiction." Is it not amazing, that a critic who reasons so justly with respect to others, can be so blind with respect to himself? Voltaire, not satisfied to enrich his language with images drawn from invisible and superior beings, introduces them into the action: in the sixth canto of the *Henriade*, St Louis appears in person, and terrifies the soldiers; in the seventh canto, St Louis sends the god of Sleep to Henry; and in the tenth, the Demons of Discord, Fanaticism, War, &c. assist Aumale in a single combat with Turenne, and are driven away by a good angel brandishing the sword of God. To blend such fictitious personages in the same action with mortals, makes a bad figure at any rate; and is intolerable in a history so recent as that of Henry IV. But perfection is not the lot of man.

But perhaps the most successful weapon that can be employed upon this subject is ridicule. Addison has applied this in an elegant manner: "Whereas the time of a general peace is, in all appearance, drawing near; being informed that there are several ingenious persons who intend to show their talents on so happy an occasion, and being willing, as much as in me lies, to prevent that effusion of nonsense which we have good cause to apprehend; I do hereby strictly require every person who shall write on this subject, to remember that he is a Christian, and not to sacrifice his catechism to his poetry. In order to it, I do expect of him, in the first place, to make his own poem, without depending upon Phœbus for any part of it, or calling out for aid upon any of the muses by name. I do likewise positively forbid the sending of Mercury with any particular message or dispatch relating to the peace; and shall by no means suffer Minerva to take upon her the shape of any plenipotentiary concerned in this great work. I do further declare, that I shall not allow the Destinies to have had a hand in the deaths of the several thousands who have been slain in the late war, being of opinion that all such deaths may be well accounted for by the Christian system of powder and ball. I do therefore strictly forbid the Fates to cut the thread of man's life upon any pretence whatsoever, unless it be for the sake of rhyme. And whereas I have good reason to fear, that Neptune will have a great deal of business on his hands in several poems which we may now suppose are upon the anvil, I do also prohibit his appearance, unless it be done in metaphor, simile, or any very short allusion; and that even here he may not be permitted to enter, but with great caution and circumspection. I desire that the same rule may be extended to his whole fraternity of Heathen gods; it being my design to condemn every poem to the flames in which Jupiter thunders, or exercises any other act of authority which does not belong to him. In short I expect that no pagan agent shall be introduced, or any fact related which a man cannot give credit to with a good conscience. Provided always that nothing herein contained shall extend, or be construed to extend to several of the female poets in this nation, who shall still be left in full possession of their gods and goddesses, in the same manner as if this paper had never been written." *Spect*. N° 523.

The marvellous is indeed so much promoted by machinery, that it is not wonderful to find it embraced by the bulk of writers, and perhaps of readers. If indulged at all, it is generally indulged to excess. Homer introduceth his deities with no greater ceremony than his mortals; and Virgil has still less moderation: a pilot spent with watching cannot fall asleep and drop into the sea by natural means: one bed cannot receive the two lovers Æneas and Dido, without the immediate interposition of superior powers. The ridiculous in such fictions must appear even through the thickest veil of gravity and solemnity.

Angels and devils serve equal with Heathen deities as materials for figurative language; perhaps better among Christians, because we believe in them, and not in Heathen deities. But every one is sensible, as well as Boileau, that the invisible powers in our creed make a much worse figure as actors in a modern poem than the invisible powers in the Heathen creed did in ancient poems; the cause of which is not far to seek. The Heathen deities, in the opinion of their votaries, were beings elevated one step only above mankind, subject to the same passions, and directed by the same motives; therefore not altogether improper to mix with men in an important action. In our creed superior beings are placed at such a mighty distance from us, and are of a nature so different, that with no propriety can we appear with them upon the same stage: man, a creature much inferior, loses all dignity in the comparison.

95 An historical poem admits of allegory, &c. under proper restrictions.

There can be no doubt that an historical poem admits the embellishment of allegory as well as of metaphor, simile, or other figure. Moral truth, in particular, is finely illustrated in the allegorical manner: it amuses the fancy to find abstract terms, by a sort of magic, metamorphosed into active beings; and it is delightful to trace a general proposition in a pictured event. But allegorical beings should be confined within their own sphere, and never be admitted to mix in the principal action, nor to co-operate in retarding or advancing the catastrophe; which would have a still worse effect than invisible powers: for the impression of real existence, essential to an epic poem, is inconsistent with that figurative existence which is essential to an allegory; and therefore no method can more effectually prevent the impression of reality than the introduction of allegorical beings co-operating with those whom we conceive to be really existing. The love episode in the Henriade (canto 9.), insufferable by the discordant mixture of allegory with real life, is copied from that of Rinaldo and Armida in the *Gierusalemme Liberata*, which hath no merit

merit to entitle it to be copied. An allegorical object, such as Fame in the Æneid, and the Temple of Love in the Henriade, may find place in a description: but to introduce Discord as a real personage, imploring the assistance of Love as another real personage, to enervate the courage of the hero, is making these figurative beings act beyond their sphere, and creating a strange jumble of truth and fiction. The allegory of Sin and Death in the Paradise Lost is possibly not generally relished, though it is not entirely of the same nature with what we have been condemning; in a work comprehending the achievements of superior beings there is more room for fancy than where it is confined to human actions.

96 Episode defined.

What is the true notion of an episode? or how is it to be distinguished from the principal action? Every incident that promotes or retards the catastrophe must be part of the principal action. This clears the nature of an episode; which may be defined, "An incident connected with the principal action, but contributing neither to advance nor retard it." The descent of Æneas into hell does not advance or retard the catastrophe, and therefore is an episode. The story of Nisus and Euryalus, producing an alteration in the affairs of the contending parties, is a part of the principal action. The family-scene in the sixth book of the Iliad is of the same nature: for by Hector's retiring from the field of battle to visit his wife, the Grecians had opportunity to breathe, and even to turn upon the Trojans. The unavoidable effect of an episode according to this definition must be, to break the unity of action; and therefore it ought never to be indulged unless to unbend the mind after the fatigue of a long narration. An episode, when such is its purpose, requires the following conditions: it ought to be well connected with the principal action; it ought to be lively and interesting; it ought to be short; and a time ought to be chosen when the principal action relents (E).

97 What constitutes a good episode.

In the following beautiful episode, which closes the second book of Fingal, all these conditions are united.

"Comal was a son of Albion; the chief of an hundred hills. His deer drunk of a thousand streams; and a thousand rocks replied to the voice of his dogs. His face was the mildness of youth; but his hand the death of heroes. One was his love, and fair was she! the daughter of mighty Conloch. She appeared like a sunbeam among women, and her hair was like the wing of the raven. Her soul was fixed on Comal, and she was his companion in the chase. Often met their eyes of love, and happy were their words in secret. But Gormal loved the maid, the chief of gloomy Ardven. He watched her lone steps on the heath, the foe of unhappy Comal.

"One day, tired of the chace, when the mist had concealed their friends, Comal and the daughter of Conloch met in the cave of Ronan. It was the wonted haunt of Comal. It sides were hung with his arms; a hundred shields of thongs were there, a hundred helms of sounding steel. Rest here, said he, my love Galvina, thou light of the cave of Ronan: a deer appears on Mora's brow; I go, but soon will return. I fear, said she, dark Gormal my foe: I will rest here; but soon return, my love.

"He went to the deer of Mora. The daughter of Conloch, to try his love, clothed her white side with his armour, and strode from the cave of Ronan. Thinking her his foe, his heart beat high, and his colour changed. He drew the bow: the arrow flew: Galvina fell in blood. He ran to the cave with hasty steps, and called the daughter of Conloch. Where art thou, my love? but no answer.——He marked, at length, her heaving heart beating against the mortal arrow. O Conloch's daughter, is it thou!—he sunk upon her breast.

"The hunters found the hapless pair. Many and silent were his steps round the dark dwelling of his love. The fleet of the ocean came: he fought, and the strangers fell: he searched for death over the field; but who could kill the mighty Comal? Throwing away his shield, an arrow found his manly breast. He sleeps with his Galvina: their green tombs are seen by the mariner when he bounds on the waves of the north."

98 Double plot in a drama seldom successful.

Next, upon the peculiarities of a *dramatic poem*. And the first we shall mention is a double plot: one of which must resemble an episode in an epic poem; for it would distract the spectator, instead of entertaining him, if he were forced to attend at the same time to two capital plots equally interesting. And even supposing it an under-plot like an episode, it seldom hath a good effect in tragedy, of which simplicity is a chief property; for an interesting subject that engages our affections, occupies our whole attention, and leaves no room for any separate concern. Variety is more tolerable in comedy; which pretends only to amuse, without totally occupying the mind. But even there, to make a double plot agreeable, is no slight effort of art: the under plot ought not to vary greatly in its tone from the principal; for discordant emotions are unpleasant when jumbled together; which, by the way, is an insuperable objection to tragi-comedy. Upon that account the Provok'd Husband deserves censure; all the scenes that bring the family of the Wrongheads into action, being ludicrous and farcical, are in a very different tone from the principal scenes, displaying severe and bitter expostulations between Lord Townley and his lady. The same objection touches not the double plot of the Careless Husband; the different subjects being sweetly connected, and having only so much variety as to resemble shades of colours harmoniously mixed. But this is not all. The under-plot ought to be connected with that which is principal, so much at least as to employ the same persons; the under-plot ought to occupy the intervals or pauses of the principal action; and both ought to be concluded together. This is the case of the Merry Wives of Windsor.

99 Violent actions ought not to be represented.

Violent action ought never to be represented on the stage. While the dialogue goes on, a thousand particulars

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(E) Homer's description of the shield of Achilles is properly introduced at a time when the action relents, and the reader can bear an interruption. But the author of Telemachus describes the shield of that young hero in the heat of battle; a very improper time for an interruption.

culars concur to delude us into an impression of reality; genuine sentiments, passionate language, and persuasive gesture; the spectator, once engaged, is willing to be deceived, loses sight of himself, and without scruple enjoys the spectacle as a reality. From this absent state he is roused by violent action; he wakes as from a pleasing dream; and, gathering his senses about him, finds all to be a fiction. Horace delivers the same rule; and founds it upon the same reason:

> Ne pueros coram populo Medea trucidet;
> Aut humana palam coquat exta nefarius Atreus;
> Aut in avem Progne vertatur, Cadmus in anguem:
> Quodcumque ostendis mihi sic, incredulus odi.

The French critics join with Horace in excluding blood from the stage; but overlooking the most substantial objection, they urge only that it is barbarous and shocking to a polite audience. The Greeks had no notion of such delicacy, or rather effeminacy; witness the murder of Clytemnestra by her son Orestes, passing behind the scene, as represented by Sophocles: her voice is heard calling out for mercy, bitter expostulations on his part, loud shrieks upon her being stabbed, and then a deep silence. An appeal may be made to every person of feeling, whether this scene be not more horrible than if the deed had been committed in sight of the spectators upon a sudden gust of passion. If Corneille, in representing the affair between Horatius and his sister, upon which the murder ensues behind the scene, had no other view but to remove from the spectators a shocking action, he was guilty of a capital mistake: for murder in cold blood, which in some measure was the case as represented, is more shocking to a polite audience, even where the conclusive stab is not seen, than the same act performed in their presence by violent and unpremeditated passion, as suddenly repented of as committed. Addison's observation is just *, That no part of this incident ought to have been represented, but reserved for a narrative, with every alleviating circumstance in favour of the hero.

100
The proper conduct of the dialogue.

A few words upon the dialogue, which ought to be so conducted as to be a true representation of nature. We talk not here of the sentiments nor of the language (which are treated elsewhere); but of what properly belongs to dialogue-writing; where every single speech, short or long, ought to arise from what is said by the former speaker, and furnish matter for what comes after till the end of the scene. In this view, all the speeches from first to last represent so many links of one regular chain. No author, ancient or modern, possesses the art of dialogue equal to Shakespeare. Dryden, in that particular, may justly be placed as his opposite. He frequently introduces three or four persons speaking upon the same subject, each throwing out his own notions separately, without regarding what is said by the rest: take for an example the first scene of Aurenzebe. Sometimes he makes a number club in relating an event, not to a stranger, supposed ignorant of it, but to one another, for the sake merely of speaking; of which notable sort of dialogue we have a specimen in the first scene of the first part of the Conquest of Grenada. In the second part of the same tragedy, scene second, the King, Abenamar, and Zulema, make their separate observations, like so many soliloquies, upon the fluctuating temper of the mob; a dialogue so uncouth puts one in mind of two shepherds in a pastoral excited by a prize to pronounce verses alternately, each in praise of his own mistress.

This manner of dialogue-writing, besides an unnatural air, has another bad effect; it stays the course of the action, because it is not productive of any consequence. In Congreve's comedies, the action is often suspended to make way for a play of wit.

No fault is more common among writers than to prolong a speech after the impatience of the person to whom it is addressed ought to prompt him or her to break in. Consider only how the impatient actor is to behave in the mean time. To express his impatience in violent action without interrupting would be unnatural; and yet to dissemble his impatience, by appearing cool where he ought to be highly inflamed, would be no less so.

Rhyme being unnatural and disgustful in dialogue, is happily banished from our theatre: the only wonder is that it ever found admittance, especially among a people accustomed to the more manly freedom of Shakespeare's dialogue. By banishing rhyme, we have gained so much as never once to dream that there can be any further improvement. And yet, however suitable blank verse may be to elevated characters and warm passions, it must appear improper and affected in the mouths of the lower sort. Why then should it be a rule, That every scene in tragedy must be in blank verse? Shakespeare, with great judgment, has followed a different rule; which is, to intermix prose with verse, and only to employ the latter where it is required by the importance or dignity of the subject. Familiar thoughts and ordinary facts ought to be expressed in plain language: to hear, for example a footman deliver a simple message in blank verse must appear ridiculous to every one who is not biassed by custom. In short, that variety of characters and of situations, which is the life of a play, requires not only a suitable variety in the sentiments, but also in the diction.

§ 3. *The Three Unities.*

When we consider the chain of causes and effects in the material world, independent of purpose, design, or thought, we find a number of incidents in succession, without beginning, middle, or end: every thing that happens is both a cause and an effect; being the effect of what goes before, and the cause of what follows: one incident may affect us more, another less; but all of them are links in the universal chain: the mind, in viewing these incidents, cannot rest or settle ultimately upon any one; but is carried along in the train without any close.

101
In what the unity of action consists.

But when the intellectual world is taken under view, in conjunction with the material, the scene is varied. Man acts with deliberation, will, and choice: he aims at some end; glory, for example, or riches, or conquest, the procuring happiness to individuals, or to his country in general: he proposes means, and lays plans to attain the end proposed. Here are a number of facts or incidents leading to the end in view, the whole composing one chain by the relation of cause and effect. In running over a series of such facts or incidents, we cannot rest upon any one; because they are presented to us as means only, leading to some end; but we rest with satisfaction upon the end or ultimate event; because there the purpose or aim of the chief person or persons is accomplished. This indicates the beginning, the middle, and the end, of what Aristotle calls *an entire action* *. The story naturally begins with describing those circumstances which move the person who acts the principal part to form a plan, in order to compass some desired event; the prosecution of that plan, and the obstructions, carry the reader into the heat of action; the middle is properly where the action is the most involved; and the end is where the event is brought about, and the plan accomplished.

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* *Spectator*, N° 43.

We have given the foregoing example of a plan crowned with success, because it affords the clearest conception of a beginning, a middle, and an end, in which consists *unity* of action; and indeed stricter unity cannot be imagined than in that case. But an action may have unity, or a beginning, middle, and end, without so intimate a relation of parts; as where the catastrophe is different from what is intended or desired, which frequently happens in our best tragedies. In the Æneid, the hero, after many obstructions, makes his plan effectual. The Iliad is formed upon a different model: it begins with the quarrel between Achilles and Agamemnon; goes on to describe the several effects produced by that cause; and ends in a reconciliation. Here is unity of action, no doubt, a beginning, a middle, and an end; but inferior to that of the Æneid, which will thus appear. The mind hath a propensity to go forward in the chain of history; it keeps always in view the expected event; and when the incidents or underparts are connected by their relation to the event, the mind runs sweetly and easily along them. This pleasure we have in the Æneid. It is not altogether so pleasant to connect, as in the Iliad, effects by their common cause; for such connection forces the mind to a continual retrospect; looking backward is like walking backward.

Elem. of Criticism.

102 Unity of action a capital beauty.

If unity of action be a capital beauty in fable imitative of human affairs, a plurality of unconnected fables must be a capital deformity. For the sake of variety we indulge an under-plot that is connected with the principal; but two unconnected events are extremely unpleasant, even where the same actors are engaged in both. Ariosto is quite licentious in that particular: he carries on at the same time a plurality of unconnected stories. His only excuse is, that his plan is perfectly well adjusted to his subject; for every thing in the *Orlando Furioso* is wild and extravagant.

Though to state facts in the order of time be natural, yet that order may be varied for the sake of conspicuous beauties. If, for example, a noted story, cold and simple in its first movements, be made the subject of an epic poem, the reader may be hurried into the heat of action; reserving the preliminaries for a conversation piece, if thought necessary; and that method, at the same time, has a peculiar beauty from being dramatic. But a privilege that deviates from nature ought to be sparingly indulged; and yet romance writers make no difficulty of presenting to the reader, without the least preparation, unknown persons engaged in some arduous adventure equally unknown. In Cassandra, two personages, who afterwards are discovered to be the heroes of the fable, start up completely armed upon the banks of the Euphrates, and engage in a single combat.

A play analysed is a chain of connected facts, of which each scene makes a link. Each scene, accordingly, ought to produce some incident relative to the catastrophe or ultimate event, by advancing or retarding it. A scene that produceth no incident, and for that reason may be termed *barren*, ought not to be indulged, because it breaks the unity of action: a barren scene can never be intitled to a place, because the chain is complete without it. In the Old Bachelor, the 3d scene of act 2. and all that follow to the end of that act, are mere conversation-pieces, productive of no consequence. The 10th and 11th scenes, act 3. Double Dealer, and the 10th, 11th, 12th, 13th, and 14th scenes, act 1. Love for Love, are of the same kind. Neither is The Way of the World entirely guiltless of such scenes. It will be no justification that they help to display characters: it were better, like Dryden in his *dramatis personæ*, to describe characters beforehand, which would not break the chain of action. But a writer of genius has no occasion for such artifice; he can display the characters of his personages much more to the life in sentiment and action. How successfully is this done by Shakespeare! in whose works there is not to be found a single barren scene.

Upon the whole, it appears, that all the facts in an historical fable ought to have a mutual connection, by their common relation to the grand event or catastrophe. And this relation, in which the *unity* of action consists, is equally essential to epic and dramatic compositions.

103 Whether unity of time and of place be essential.

How far the unities of time and of place are essential, is a question of greater intricacy. These unities were strictly observed in the Greek and Roman theatres; and they are inculcated by the French and English critics as essential to every dramatic composition. In theory these unities are also acknowledged by our best poets, though their practice seldom corresponds: they are often forced to take liberties, which they pretend not to justify, against the practice of the Greeks and Romans, and against the solemn decision of their own countrymen. But in the course of this inquiry it will be made evident, that in this article we are under no necessity to copy the ancients; and that our critics are guilty of a mistake, in admitting no greater latitude of place and time than was admitted in Greece and Rome.

Indeed the unities of place and time are not, by the most rigid critics, required in a narrative poem. In such composition, if it pretend to copy nature, these unities would be absurd; because real events are seldom confined within narrow limits either of place or of time: and yet we can follow history, or an historical fable, through all its changes, with the greatest facility; we never once think of measuring the real time by what is taken in reading; nor of forming any connection between the place of action and that which we occupy.

We are aware, that the drama differs so far from the epic as to admit different rules. It will be observed, "That an historical fable, intended for reading solely, is under no limitation of time or of place more than a genuine history; but that a dramatic composition cannot be accurately represented unless it be limited, as its representation is, to one place and to a few hours; and therefore that no fable can be admitted but what has these properties, because it would be absurd to compose a piece for representation that cannot be justly represented." This argument has at least a plausible appearance; and yet one is apt to suspect some fallacy, considering that no critic, however strict, has ventured to confine the unities of place and of time within so narrow bounds.

A view of the Grecian drama, compared with our own, may perhaps relieve us from this dilemma: if they be differently constructed, as shall be made evident, it is possible that the foregoing reasoning may not be equally applicable to both.

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* Poet. c. 6.

104 They were essential to the Greek drama, but

All authors agree, that tragedy in Greece was derived from the hymns in praise of Bacchus, which were sung in parts by a chorus. Thespis, to relieve the singers, and for the sake of variety, introduced one actor, whose province it was to explain historically the subject of the song, and who occasionally represented one or other personage. Eschylus, introducing a second actor, formed the dialogue, by which the performance became dramatic; and the actors were multiplied when the subject represented made it necessary. But still the chorus, which gave a beginning to tragedy, was considered as an essential part. The first scene, generally, unfolds the preliminary circumstances that lead to the grand event; and this scene is by Aristotle termed the *prologue*. In the second scene, where the action properly begins, the chorus is introduced, which, as originally, continues upon the stage during the whole performance: the chorus frequently makes one in the dialogue; and when the dialogue happens to be suspended, the chorus, during the interval, is employed in singing. Sophocles adheres to this plan religiously. Euripides is not altogether so correct. In some of his pieces it becomes necessary to remove the chorus for a little time: but when that unusual step is risked, matters are so ordered as not to interrupt the representation: the chorus never leave the stage of their own accord, but at the command of some principal personage, who constantly waits their return.

Thus the Grecian drama is a continued representation without any interruption; a circumstance that merits attention. A continued representation without a pause affords not opportunity to vary the place of action, nor to prolong the time of the action beyond that of the representation. To a representation so confined in place and time, the foregoing reasoning is strictly applicable: a real or feigned action, that is brought to a conclusion after considerable intervals of time and frequent changes of place, cannot accurately be copied in a representation that admits no latitude in either. Hence it is, that the unities of place and of time, were, or ought to have been, strictly observed in the Greek tragedies; which is made necessary by the very constitution of their drama, for it is absurd to compose a tragedy that cannot be justly represented.

105 not to the French or English.

Modern critics, who for our drama pretend to establish rules founded on the practice of the Greeks, are guilty of an egregious blunder. The unities of place and of time were in Greece, as we see, a matter of necessity, not of choice; and it is easy to show, that if we submit to such fetters, it must be from choice, not necessity. This will be evident upon taking a view of the constitution of our drama, which differs widely from that of Greece; whether more or less perfect, is a different point, to be handled afterward. By dropping the chorus, opportunity is afforded to divide the representation by intervals of time, during which the stage is evacuated, and the spectacle suspended. This qualifies our drama for subjects spread through a wide space both of time and of place: the time supposed to pass during the suspension of the representation is not measured by the time of the suspension; and any place may be supposed, as it is not in sight: by which means, many subjects can be justly represented in our theatres, that were excluded from those of ancient Greece. This doctrine may be illustrated, by comparing a modern play to a set of historical pictures; let us suppose them five in number, and the resemblance will be complete: each of the pictures resembles an act in one of our plays: there must necessarily be the strictest unity of place and of time in each picture; and the same necessity requires these two unities during each act of a play, because during an act there is no interruption in the spectacle. Now, when we view in succession a number of such historical pictures, let it be, for example, the history of Alexander by Le Brun, we have no difficulty to conceive, that months or years have passed between the events exhibited in two different pictures, though the interruption is imperceptible in passing our eye from the one to the other; and we have as little difficulty to conceive a change of place, however great: in which view there is truly no difference between five acts of a modern play and five such pictures. Where the representation is suspended, we can with the greatest facility suppose any length of time or any change of place; the spectator, it is true, may be conscious, that the real time and place are not the same with what are employed in the representation; but this is the work of reflection; and by the same reflection he may also be conscious, that Garrick is not King Lear, that the playhouse is not Dover cliffs, nor the noise he hears thunder and lightning. In a word, after an interruption of the representation, it is not more difficult for a spectator to imagine a new place, or a different time, than, at the commencement of the play, to imagine himself at Rome, or in a period of time two thousand years back. And indeed, it is abundantly ridiculous, that a critic, who is willing to hold candle-light for sunshine, and some painted canvasses for a palace or a prison, should affect so much difficulty in imagining a latitude of place or of time in the fable, beyond what is necessary in the representation.

106 Great latitude in time, however, not to be indulged.

There are, it must be acknowledged, some effects of great latitude in time that ought never to be indulged in a composition for the theatre: nothing can be more absurd, than at the close to exhibit a full-grown person who appears a child at the beginning: the mind rejects, as contrary to all probability, such latitude of time as is requisite for a change so remarkable. The greatest change from place to place hath not altogether the same bad effect: in the bulk of human affairs place is not material; and the mind, when occupied with an interesting event, is little regardful of minute circumstances: these may be varied at will, because they scarcely make any impression.

107 nor in place.

At the same time, it is not here meant to justify liberty without any reserve. An unbounded licence with relation to place and time, is faulty, for a reason that seems to have been overlooked, which is, that it seldom fails to break the unity of action; in the ordinary course of human affairs, single events, such as are fit to be represented on the stage, are confined to a narrow spot, and generally employ no great extent of time; and accordingly we seldom find strict unity of action in a dramatic composition, where any remarkable latitude is indulged in these particulars. It may even be admitted, that a composition which employs but one place, and requires not a greater length of time than is necessary for the representation, is

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so much the more perfect; because the confining an event within so narrow bounds, contributes to the unity of action, and also prevents that labour, however slight, which the mind must undergo in imagining frequent changes of place, and many intervals of time. But still we must insist that such limitation of place and time as was necessary in the Grecian drama, is no rule to us; and therefore, that though such limitation adds one beauty more to the composition, it is at best but a refinement, which may justly give place to a thousand beauties more substantial. And we may add, that it is extremely difficult, if not impracticable, to contract within the Grecian limits any fable so fruitful of incidents in number and variety as to give full scope to the fluctuation of passion.

It may now appear, that critics who put the unities of place and of time upon the same footing with the unity of action, making them all equally essential, have not attended to the nature and constitution of the modern drama. If they admit an interrupted representation, with which no writer finds fault, it is absurd to reject its greatest advantage, that of representing many interesting subjects excluded from the Grecian stage. If there needs must be a reformation, why not restore the ancient chorus and the ancient continuity of action? There is certainly no medium; for to admit an interruption without relaxing from the strict unities of place and of time, is in effect to load us with all the inconveniences of the ancient drama, and at the same time to withhold from us its advantages.

108 **Whether our drama be preferable to that of Greece.**

And therefore the only proper question is, Whether our model be or be not a real improvement? This indeed may fairly be called in question; and in order to a comparative trial, some particulars must be premised. When a play begins, we have no difficulty to adjust our imagination to the scene of action, however distant it be in time or in place; because we know that the play is a representation only. The case is very different after we are engaged: it is the perfection of representation to hide itself, to impose on the spectator, and to produce in him an impression of reality, as if he were spectator of a real event; but any interruption annihilates that impression, by rousing him out of his waking dream, and unhappily restoring him to his senses. So difficult it is to support the impression of reality, that much slighter interruptions than the interval between two acts are sufficient to dissolve the charm: in the 5th act of the *Mourning Bride*, the three first scenes are in a room of state, the fourth in the prison; and the change is operated by shifting the scene, which is done in a trice: but however quick the transition may be, it is impracticable to impose upon the spectators so as to make them conceive that they are actually carried from the palace to the prison; they immediately reflect, that the palace and prison are imaginary, and that the whole is a fiction.

From these premises, one will naturally be led, at first view, to pronounce the frequent interruptions in the modern drama to be an imperfection. It will occur, "That every interruption must have the effect to banish the dream of reality, and with it to banish our concern, which cannot subsist while we are conscious that all is a fiction; and therefore, that in the modern drama, sufficient time is not afforded for fluctuation and swelling of passion, like what is afforded in that of Greece, where there is no interruption." This reasoning, it must be owned, has a specious appearance: but we must not become faint-hearted upon the first repulse; let us rally our troops for a second engagement.

On the Greek stage, whatever may have been the case on the Roman, the representation was never interrupted, and the division by acts was totally unknown. The word *act* never once occurs in Aristotle's Poetics, in which he defines exactly every part of the drama, and divides it into the beginning, the middle, and the end. At certain intervals indeed the actors retired; but the stage was not then left empty, nor the curtain let fall; for the chorus continued and sung. Neither do these songs of the chorus divide the Greek tragedies into five portions similar to our acts: though some of the commentators have endeavoured to force them into this office. But it is plain, that the intervals at which the chorus sung are extremely unequal and irregular, suited to the occasion and the subject; and would divide the play sometimes into three, sometimes into seven or eight acts.

As practice has now established a different plan on the modern stage, has divided every play into five acts, and made a total pause in the representation at the end of each act, the question to be considered is, Whether the plan of the ancient or of the modern drama is best qualified for making a deep impression on the mind? That the preference is due to the plan of the modern drama, will be evident from the following considerations. If it be indeed true, as the advocates for the three unities allege, that the audience is deluded into the belief of the reality of a well-acted tragedy, it is certain that this delusion cannot be long supported; for when the spirits are exhausted by close attention, and by the agitation of passion, an uneasiness ensues, which never fails to banish the waking-dream. Now supposing the time that a man can employ with strict attention without wandering to be no greater than is requisite for a single act (a supposition that cannot be far from truth), it follows, that a continued representation of longer endurance than an act, instead of giving scope to fluctuation and swelling of passion, would overstrain the attention, and produce a total absence of mind. In this respect, the four pauses have a fine effect: for by affording to the audience a seasonable respite when the impression of reality is gone, and while nothing material is in agitation, they relieve the mind from its fatigue: and consequently prevent a wandering of thought at the very time possibly of the most interesting scenes.

In one article, indeed, the Grecian model has greatly the advantage: its chorus, during an interval, not only preserves alive the impressions made upon the audience, but also prepares their hearts finely for new impressions. In our theatres, on the contrary, the audience, at the end of every act, being left to trifle time away, lose every warm impression; and they begin the next act cool and unconcerned, as at the commencement of the representation. This is a gross malady in our theatrical representations; but a malady that luckily is not incurable: to revive the Grecian chorus, would be to revive the Grecian slavery of place and time; but we can figure a detached chorus coinciding with a pause in the representation, as the ancient chorus did with a pause in the principal action. What objection, for example, can there lie against music between the acts, vocal and instrumental, 109 An improvement of the modern drama suggested.

instrumental, adapted to the subject? Such detached chorus, without putting us under any limitation of time or place, would recruit the spirits, and would preserve entire the tone, if not the tide, of passion: the music, after an act, should commence in the tone of the preceding passion, and be gradually varied till it accord with the tone of the passion that is to succeed in the next act. The music and the representation would both of them be gainers by their conjunction; which will thus appear. Music that accords with the present tone of mind, is, on that account, doubly agreeable; and accordingly, though music singly hath not power to raise a passion, it tends greatly to support a passion already raised. Further, music prepares us for the passion that follows, by making cheerful, tender, melancholy, or animated impressions, as the subject requires. Take for an example the first scene of the *Mourning Bride*, where soft music, in a melancholy strain, prepares us for Almeria's deep distress. In this manner, music and representation support each other delightfully: the impression made upon the audience by the representation, is a fine preparation for the music that succeeds; and the impression made by the music is a fine preparation for the representation that succeeds. It appears evident, that by some such contrivance, the modern drama may be improved, so as to enjoy the advantage of the ancient chorus without its slavish limitation of place and time. But to return to the comparison between the ancient and the modern drama.

110 The modern drama preferable to the ancient.

The numberless improprieties forced upon the Greek dramatic poets by the constitution of their drama, may be sufficient, one should think, to make us prefer the modern drama, even abstracting from the improvement proposed. To prepare the reader for this article, it must be premised, that as in the ancient drama the place of action never varies, a place necessarily must be chosen to which every person may have access without any improbability. This confines the scene to some open place, generally the court or area before a palace; which excludes from the Grecian theatre transactions within doors, though these commonly are the most important. Such cruel restraint is of itself sufficient to cramp the most pregnant invention; and accordingly the Greek writers, in order to preserve unity of place, are reduced to woful improprieties. In the *Hippolytus* of Euripides (act i. sc. 6.), Phædra, distressed in mind and body, is carried without any pretext from her palace to the place of action; is there laid upon a couch, unable to support herself upon her limbs; and made to utter many things improper to be heard by a number of women who form the chorus: and what is still more improper, her female attendant uses the strongest entreaties to make her reveal the secret cause of her anguish; which at last Phædra, contrary to decency and probability, is prevailed upon to do in presence of that very chorus (act ii. sc. 2.). Alcestes, in Euripides, at the point of death, is brought from the palace to the place of action, groaning and lamenting her untimely fate (act ii. sc. 1.). In the *Trachiniæ* of Sophocles (act ii.), a secret is imparted to Dejanira, the wife of Hercules, in presence of the chorus. In the tragedy of *Iphigenia*, the messenger employed to inform Clytemnestra that Iphigenia was sacrificed, stops short at the place of action, and with a loud voice calls the queen from her palace to hear the news. Again, in the *Iphigenia in Tauris* (act iv.), the necessary presence of the chorus forces Euripides into a gross absurdity, which is to form a secret in their hearing; and, to disguise the absurdity, much court is paid to the chorus, not one woman but a number, to engage them to secrecy. In the *Medea* of Euripides, that princess makes no difficulty, in presence of the chorus, to plot the death of her husband, of his mistress, and of her father the king of Corinth, all by poison: it was necessary to bring Medea upon the stage; and there is but one place of action, which is always occupied by the chorus. This scene closes the second act; and in the end of the third, she frankly makes the chorus her confidants in plotting the murder of her own children. Terence, by identity of place, is often forced to make a conversation within doors be heard on the open street: the cries of a woman in labour are there heard distinctly.

111 Inconveniences of the plan of the ancient drama.

The Greek poets are not less hampered by unity of time than by that of place. In the *Hippolytus* of Euripides, that prince is banished at the end of the 4th act; and in the first scene of the following act, a messenger relates to Theseus the whole particulars of the death of Hippolytus by the sea-monster: that remarkable event must have occupied many hours; and yet in the representation it is confined to the time employed by the chorus upon the song at the end of the 4th act. The inconsistency is still greater in the *Iphigenia in Tauris* (act v. sc. 4.): the song could not exhaust half an hour; and yet the incidents supposed to have happened during that time could not naturally have been transacted in less than half a day.

The Greek artists are forced, not less frequently, to transgress another rule, derived also from a continued representation. The rule is, that as a vacuity, however momentary, interrupts the representation, it is necessary that the place of action be constantly occupied. Sophocles, with regard to that rule as well as to others, is generally correct: but Euripides cannot bear such restraint; he often evacuates the stage, and leaves it empty for others. Iphigenia in Tauris, after pronouncing a soliloquy in the first scene, leaves the place of action, and is succeeded by Orestes and Pylades: they, after some conversation, walk off; and Iphigenia re-enters, accompanied with the chorus. In the Alcestes, which is of the same author, the place of action is void at the end of the third act. It is true, that to cover the irregularity, and to preserve the representation in motion, Euripides is careful to fill the stage without loss of time: but this is still an interruption, and a link of the chain broken: for during the change of the actors, there must be a space of time, during which the stage is occupied by neither set. It makes indeed a more remarkable interruption, to change the place of action as well as the actors; but that was not practicable upon the Grecian stage.

It is hard to say upon what model Terence has formed his plays. Having no chorus, there is a pause in the representation at the end of every act: but advantage is not taken of the cessation, even to vary the place of action; for the street is always chosen, where every thing passing may be seen by every person; and by that choice, the most sprightly and interesting parts of the action, which commonly passes within doors, are excluded;

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ed; witness the last act of the *Eunuch*. He hath submitted to the like slavery with respect to time. In a word, a play with a regular chorus, is not more confined in place and time than his plays are. Thus a zealous sectary follows implicitly ancient forms and ceremonies, without once considering whether their introductive cause be still subsisting. Plautus, of a bolder genius than Terence, makes good use of the liberty afforded by an interrupted representation: he varies the place of action upon all occasions, when the variation suits his purpose.

112 No change of time or place to be admitted but between the acts.

The intelligent reader will by this time understand, that we plead for no change of place in our plays but after an interval, nor for any latitude in point of time but what falls in with an interval. The unities of place and time ought to be strictly observed during each act; for during the representation there is no opportunity for the smallest deviation from either. Hence it is an essential requisite, that during an act the stage be always occupied; for even a momentary vacuity makes an interval or interruption. Another rule is no less essential: it would be a gross breach of the unity of action to exhibit upon the stage two separate actions at the same time; and therefore, to preserve that unity, it is necessary that each personage introduced during an act be linked to those in possession of the stage, so as to join all in one action. These things follow from the very conception of an act, which admits not the slightest interruption: the moment the representation is intermitted, there is an end of that act; and we have no other notion of a new act, but where, after a pause or interval, the representation is again put in motion. French writers, generally speaking, are correct in this particular. The English, on the contrary, are so irregular as scarce to deserve a criticism; actors not only succeed each other in the same place without connection, but, what is still less excusable, they frequently succeed each other in different places. This change of place in the same act ought never to be indulged; for, beside breaking the unity of the act, it has a disagreeable effect: after an interval, the imagination adapts itself to any place that is necessary, as readily as at the commencement of the play; but during the representation we reject change of place. From the foregoing censure must be excepted the *Mourning Bride* of Congreve, where regularity concurs with the beauty of sentiment and of language, to make it one of the most complete pieces England has to boast of. It is acknowledged, however, that in point of regularity this elegant performance is not altogether unexceptionable. In the four first acts, the unities of place and time are strictly observed: but in the last act, there is a capital error with respect to unity of place; for in the three first scenes of that act, the place of action is a room of state, which is changed to a prison in the fourth scene: the chain also of the actors is broken; as the persons introduced in the prison are different from those who made their appearance in the room of state. This remarkable interruption of the representation makes in effect two acts instead of one: and therefore, if it be a rule that a play ought not to consist of more acts than five, this performance is so far defective in point of regularity. It may be added, that, even admitting six acts, the irregularity would not be altogether removed, without a longer pause in the representation than is allowed in the acting; for more than a momentary interruption is requisite for enabling the imagination readily to fall in with a new place, or with a wide space of time. In *The Way of the World*, of the same author, unity of place is preserved during every act, and a stricter unity of time during the whole play than is necessary.

§ 4. *Of the Opera.*

113 The opera, a drama represented by music.

An opera is a drama represented by music. This entertainment was invented at Venice. An exhibition of this sort requires a most brilliant magnificence, and an expence truly royal. The drama must necessarily be composed in verse: for as operas are sung and accompanied with symphonies, they must be in verse to be properly applicable to music. To render this entertainment still more brilliant, it is ornamented with dances and ballets, with superb decorations, and surprising machinery. The dresses of the actors, of those who assist in the chorus, and of the dancers, being all in the most splendid and elegant taste, contribute to render the exhibition highly sumptuous. But notwithstanding this union of arts and pleasures at an immense expence, and notwithstanding a most dazzling pageantry, an opera appears, in the eyes of many people of taste, but as a magnificent absurdity, seeing that nature is never there from the beginning to the end. It is not our business here, however, to determine between the different tastes of mankind.

Bielfeld's *Elem. of Erudition.*

The method of expressing our thoughts by singing and music is so little natural, and has something in it so forced and affected, that it is not easy to conceive how it could come into the minds of men of genius to represent any human action, and, what is more, a serious or tragic action, any otherwise than by speech. We have, it is true, operas in English by Addison, &c. in Italian by Metastasio, in French by M. Quinault, Fontenelle, &c. the subjects of which are so grave and tragic, that one might call them musical tragedies, and real *chefs d'œuvres* in their kind. But though we are highly satisfied and greatly affected on reading them, and are much pleased with seeing them represented, yet the spectator is, perhaps, more charmed with the magnificence of the sight and the beauty of the music, than moved with the action and the tragical part of the performance. We are not, however, of that order of critics who strive to prove, that mankind act wrong in finding pleasure in an object with which they are really pleased; who blame a lover for thinking his mistress charming, when her features are by no means regular; and who are perpetually applying the rules of logic to the works of genius: we make these observations merely in order to examine if it be not possible to augment the pleasures of a polite people, by making the opera something more natural, more probable, and more consonant to reason.

114 should take its subject not from history but from fable and enchantment.

We think, therefore, that the poet should never, or at least very rarely, choose a subject from history, but from fable or mythology, or from the regions of enchantment. Every rational mind is constantly shocked to hear a mutilated hero trill out, from the slender pipe of a chaffinch, *To arms! To arms!* and in the same tone animate his soldiers, and lead them to the assault; or harangue an assembly of grave senators, and sometimes a whole body of people. Nothing can be more burlesque than such exhibitions; and a man must be possessed of a very uncommon sensibility to be affected by them. But as we know not what was the language of the gods, and their manner of expressing themselves, we are at liberty in that case to form what illusions we please, and to suppose that they sung to distinguish themselves from mortals. Besides, all the magic of decorations and machinery become natural, and even necessary, in these kinds of subjects; and therefore readily afford opportunity for all the pomp of these performances. The chorus, the dances, the ballettes, the symphonies and dresses, may likewise be all made to correspond with such subjects, nothing is here affected, absurd, or unnatural. Whoever is possessed of genius, and is well acquainted with mythology, will there find an inexhaustible source of subjects highly diversified and quite proper for the drama of an opera.

115
And should represent its characters as consistent.

We shall not speak here of that sort of music which appears to us the most proper for such a drama, and of the several alterations of which we think it susceptible in order to make it more complete, and to adapt it to a more pathetic, more noble, and more natural expression, as well in the recitatives as in the airs and chorus. (See MUSIC). We have only here to consider the business of the poet. He should never lose sight of nature even in the midst of the greatest fiction. A god, a demi-god, a renowned hero, such for example as Renaud in *Armida*, a fairy, a genii, a nymph, or fury, &c. should constantly be represented according to the characters we give them, and never be made to talk the language of a fop or a *petite maitresse*. The recitative, which is the ground-work of the dialogue, requires verses that are free and not regular, such as with a simple cadence approach the nearest to common language. The airs should not be forced into the piece, nor improperly placed for the sake of terminating a scene, or to display the voice of a performer; they should express some sentiment, or some precept, short and striking, or tender and affecting; or some simile lively and natural; and they should arise of themselves from a monologue, or from a scene between two persons: prolixity should here be particularly avoided, especially when such an air makes part of a dialogue; for nothing is more insipid or disgustful than the countenances of the other actors who appear at the same time, whose silence is quite unmeaning, and who know not what to do with their hands and feet while the singer is straining his throat. The verse of all the airs should be of the lyric kind, and should contain some poetic image, or paint some noble passion, which may furnish the composer with an opportunity of displaying his talents, and of giving a lively and affecting expression to the music. A phrase that is inanimated can never have a good effect in the performance, but must become insipid and horribly tedious in the air. The trite similies of the Italians, of a stream that flows, or a bird that flies, &c. are no longer sufferable. The same thing may be said with regard to the chorus, which should be equally natural and well adapted: it is here sometimes a whole people, sometimes the inhabitants of a peculiar country, and sometimes warriors, nymphs, or priests, &c. who raise their voice to demand justice, to implore favour, or render a general homage. The action itself will furnish the poet of genius with ideas, words, and the manner of disposing them.

116
Unity of action necessary to the opera.

Lastly, the opera being a performance calculated less to satisfy the understanding than to charm the ear and affect the heart, and especially to strike the sight, the poet should have a particular attention to that object, should be skilled in the arts of a theatre, should know how to introduce combats, ballets, feasts, games, pompous entries, solemn processions, and such marvellous incidents as occur in the heavens, upon earth, in the sea, and even in the infernal regions: but all these matters demand a strong character, and the utmost precision in the execution: for otherwise, the comic being a near neighbour to the sublime, they will easily become ridiculous. The unity of action must certainly be observed in such a poem, and all the incidental episodes must concur to the principal design; otherwise it would be a monstrous chaos. It is impossible, however, scrupulously to observe the unity of time and place: though the liberty, which reason allows the poet in this respect, is not without bounds; and the less use he makes of it, the more perfect his poem will be. It is not perhaps impossible so to arrange the objects, that, in changing the decorations, the painter may constantly make appear some part of the principal decoration which characterises the situation of the scene, as the corner of a palace, at the end of a garden, or some avenue that leads to it, &c. But all this is liable to difficulties, and even to exceptions; and the art of the painter must concur in such case with that of the poet. For the rest, all the operas of Europe are at least one third too long; especially the Italian. The unity of action requires brevity, and satiety is inseparable from a diversion that lasts full four hours, and sometimes longer.

They have indeed endeavoured to obviate this inconvenience by dividing an opera into three, and even into five acts; but experience proves, that this division, though judicious, is still not sufficient to relieve the wearied attention.

SECT. II. *Of Lyric Poetry.*

117
Origin of the ode.

THE ode is very ancient, and was probably the first species of poetry. It had its source, we may suppose, from the heart, and was employed to express, with becoming fervour and dignity, the grateful sense man entertained of the blessings which daily flowed from God the fountain of all goodness: hence their harvest hymns, and other devotional compositions of that kind.

But in process of time it was employed, not only to praise the Almighty for bounties received, but to solicit his aid in time of trouble; as is plain from the odes written by King David and others, and collected by the Jewish Sanhedrim into the book of Psalms, to be sung at their fasts, festivals, and on other solemn occasions. Nor was this practice confined to the Israelites only: other nations had their songs of praise and petitions of this sort, which they preferred to their deities, in time of public prosperity and public distress, as well as to those heroes who distinguished themselves in arms. Even the American Indians, whose notions of religion are extremely confined, have their war-songs, which they sing to this day.

It

118 Its freedom.

It is reasonable to suppose that the awful purpose to which the ode was applied, gave rise among the ancients to the custom of invoking the muses; and that the poets in order to raise their sentiments and language, so as to be acceptable to their deities, thought it expedient to solicit some divine assistance. Hence poets are said to have been inspired, and hence an unbounded liberty has been given to the ode; for the lyric poet, fired, as it were, with his subject, and borne away on the wings of gratitude, disdains grammatical niceties and common modes of speech, and often soars above rule, though not above reason. This freedom, however, consists chiefly in sudden transitions, bold digressions, and lofty excursions. For the ancient poets, and even Pindar, the most daring and lofty of them all, has in his sublimest flights, and amidst all his rapture, preserved harmony, and often uniformity in his versification: but so great is the variety of his measures, that the traces of sameness are in a manner lost; and this is one of the excellencies for which that poet is admired, and which, though seemingly devoid of art, requires so much that he has seldom been imitated with success.

The ancients in their odes indulged such a liberty of fancy, that some of their best poets not only make bold excursions and digressions, but, having in their flights started some new and noble thought, they frequently pursue it, and never more return to their subject. But this loose kind of ode, which seems to reject all method, and in which the poet, having just touched upon his subject, immediately diverts to another, we should think blameable, were it lawful to call in question the authority of those great men who were our preceptors in this art. We may venture to affirm, however, that these compositions stand in no degree of comparison with other odes of theirs; in which, after wandering from the subject in pursuit of new ideas arising from some of its adjunctions, and ranging wantonly, as it were, through a variety of matter, the poet is from some other circumstance led naturally to his subject again; and, like, a bee, having collected the essence of many different flowers, returns home, and unites them all in one uniform pleasing sweet.

119 The subjects of the ode.

The ode among the ancients signified no more than a song: but with the moderns, the ode and the song are considered as different compositions; the ode being usually employed in grave and lofty subjects, and seldom sung but on solemn occasions.

The subjects most proper for the ode and song, Horace has pointed out in a few elegant lines.

Gods, heroes, conquerors, *Olympic* crowns,
Love's pleasing cares, and the free joys of wine,
Are proper subjects for the lyric song.

To which we may add, that happiness, the pleasures of a rural life, and such parts of morality as afford lessons for the promotion of our felicity, and reflections on the conduct of life, are equally suitable to the ode. This both *Pindar* and *Horace* were so sensible of, that many of their odes are seasoned with these moral sentences and reflections.

But who can number ev'ry sandy grain
Wash'd by *Sicilia's* hoarse-resounding main?
Or who can *Theron's* gen'rous works express,
And tell how many hearts his bounteous virtues bless?
Ode to THERON.

And in another Olympic ode, inscribed by the same poet to Diagoras of Rhodes (and in such esteem, that it was deposited in the temple of Minerva, written in letters of gold), Pindar, after exalting them to the skies, concludes with this lesson in life:

Yet as the gales of fortune various blow,
To-day tempestuous, and to-morrow fair,
Due bounds, ye Rhodians, let your transports know;
Perhaps to-morrow comes a storm of care.
West's PINDAR.

The man resolv'd and steady to his trust,
Inflexible to ill, and obstinately just,
May the rude rabble's insolence despise,
Their senseless clamours and tumultuous cries;
The tyrant's fierceness he beguiles,
And the stern brow and the harsh voice defies,
And with superior greatness smiles.
Not the rough whirlwind, that deforms
Adria's black gulf, and vexes it with storms,
The stubborn virtue of his soul can move;
Nor the red arm of angry Jove,
That flings the thunder from the sky,
And gives it rage to roar, and strength to fly.
Should the whole frame of nature round him break,
In ruin and confusion hurl'd,
He unconcern'd would hear the mighty crack,
And stand secure amidst a falling world.
HORACE.

M. Despreaux has given us a very beautiful and just description of the ode in the following lines.

L'Ode avec plus d'éclat, & non moins d'énergie
Elevant jusqu'au ciel son vol ambitieux,
Entretient dans vers commerce avec les Dieux.
Aux Athletes dans Pise elle ouvre la barriere,
Chante un vainqueur poudreux au bout de la carriere;
Mene Achille sanglant au bords du Simoïs
Ou fait flechir l'Escaut sous le joug de Louis.
Tantôt comme une abeille ardente à son ouvrage
Elle s'en va de fleurs dèpouiller le rivage:
Elle peint les festins, les danses & les ris,
Vante un baiser cueilli sur les levres d'Iris,
Qui mollement résiste & par un doux caprice
Quelquefois le refuse, afin qu'on le ravisse.
Son style impetueux souvent marche au hasard.
Chez elle un beau desordre est un effet de l'art,
Loin ces rimeurs craintifs, dont l'esprit phlegmatique
Garde dans ses fureurs un ordre didactique:
Qui chantant d'un heros les progrès éclatans,
Maigres historiens, suivront l'ordre des temps.
Apollon de son feu leur fut toujours avare, &c.

The lofty ode demands the strongest fire,
For there the muse all Phœbus must inspire:
Mounting to heav'n in her ambitious flight,
Amongst the gods and heroes takes delight;
Of Pisa's wrestlers tells the sinewy force,
And sings the dusty conqueror's glorious course;

Of Lyric Poetry.

To Simois' banks now fierce Achilles sends,
Beneath the Gallic yoke now Escaut bends:
Sometimes she flies, like an industrious bee,
And robs the flowers by nature's chemistry;
Describes the shepherds dances, feasts, and bliss,
And boasts from Phillis to surprise a kiss,
When gently she resists with feign'd remorse,
That what she grants may seem to be by force.
Her generous style will oft at random start,
And by a brave disorder show her art;
Unlike those fearful poets whose cold rhyme
In all their raptures keeps exactest time,
Who sing th' illustrious hero's mighty praise,
Dry journalists, by terms of weeks and days;
To these, Apollo, thrifty of his fire,
Denies a place in the Pierian choir, &c.

Soames.

POETRY *continued in next Volume.*

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